PROMOTING TECHNOLOGICAL EXCELLENCE: THE ROLE OF STATE AND FEDERAL EXTENSION ACTIVITIES

NATIONAL GOVERNORS' ASSOCIATION

State Policy Reports

Capital Resources Policy Studies

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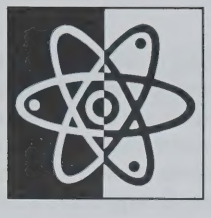

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NATIONAL GOVERNORS' ASSOCIATION

State Policy Reports

Capital Resources Policy Studies

by Marianne K. Clarke and Eric N. Dobson

Capital Resources Policy Studies
Center for Policy Research

National Governors' Association

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Preface

During the fall of 1988 and the winter of 1989, the National Governors' Association, in conjunction with the National Institute of Standards and Technology (NIST), conducted a nationwide survey of state and federal organizations providing business and technology assistance to small and medium-sized businesses. The purpose of the study was to identify the existing network of organizations providing services aimed at transferring technology, modernizing manufacturing processes, and/or improving the productivity and profitability of businesses.

The state organizations surveyed were asked to provide information on the nature of the services provided, the type of firms being assisted, and methods used to reach potential clients. In addition, the survey solicited the views of program managers regarding the needs of small and medium-sized businesses for information on new and existing technologies and ways to improve the transfer of federal technology to potential users in the small business community. Similar information was requested from federal programs that provide direct assistance to small and medium-sized businesses. These include: U.S. Small Business Administration Small Business Development Centers, Economic Development Administration University Centers, Department of Commerce Trade Adjustment Assistance Centers, and National Aeronautics and Space Administration Industrial Applications Centers.

The data presented in this report are based on 231 completed surveys. Of these, 178 were submitted by state-supported organizations, and 53 were submitted by centers established under federal programs. It is important to note that the survey was not all-inclusive. While organizations responding to the survey represent a substantial sample of assistance programs, there are undoubtedly additional programs that were not identified.

In April 1989, NGA sponsored a Roundtable on State Technology Extension Services. Participants included directors of the state extension programs, managers of federal centers, and NGA and NIST staff. The purpose of the roundtable was to review preliminary findings and provide additional insight on the operation of extension services. This report includes supplemental information from the roundtable. A list of attendees is contained in Appendix I.

Acknowledgements

The National Governors' Association wishes to thank the many invididuals who contributed time and information for the development of this report. First and foremost, thanks are due to the managers of the state and federal programs who responded to the survey.

Thanks are also due to those individuals who reviewed the manuscript and provided advice and guidance. These include the participants in the NGA/NIST Roundtable on State Technology Extension Services who are listed in Appendix I. Special thanks are due to Donald Johnson, David Edgerly, and Robert Chapman of the National Institute of Standards and Technology for their input and support throughout the project.

Finally, a number of NGA staff contributed to this effort. DeWitt John, Policy Studies Director, Capital Resources Group carefully reviewed the draft report and provided valuable comments. Marianne K. Clarke, Program Director for Economic Development, Science and Technology managed the project. Eric N. Dobson and Kristen Gooch, Senior Staff Assistants, analyzed the survey data. Gerry Feinstein and Mark R. Miller edited and produced the report and Raquel Stanton and Donna Watson provided expert secretarial support. Their contributions are gratefully acknowledged.

Executive Summary

The modernization of our existing manufacturing base is a critical issue facing the nation. To compete in world markets, U.S. firms must continually adopt new technological processes and introduce new products. Yet indications are that U.S. manufacturers have been slow to automate and use existing technologies.

A recent study of durable goods manufacturers in the Great Lakes region revealed that "of durable goods factories with fewer than 50 employees, more than 85 percent have yet to introduce a single programmable machine tool. Only 13 percent of smaller shops use computer-aided design, and fewer than 3 percent have found a use for robots, automated inspection systems, or automated materials handling."1 This failure to make the most of the nation's technological prowess has far-reaching implications affecting our standard of living and our future place in the world economy.

In 1988 Congress passed the Omnibus Trade and Competitiveness Act, aimed at improving the ability of U.S. firms to compete in global markets. Congress called on the National Institute of Standards and Technology (NIST), formerly the National Bureau of Standards, to develop and implement a program of technology development and transfer in collaboration with industry, universities, other federal agencies, and state and local governments.

As part of this effort, NIST was instructed to conduct a nationwide survey of state technology extension services and to develop recommendations for an appropriate federal role in encouraging such programs. The purpose of the study was to identify the existing network of organizations providing services aimed at transferring technology, modernizing manufacturing processes, and/or improving the productivity and profitability of businesses.

The study was designed to answer a number of questions. What type of services are being provided to small and medium-sized firms? What type of businesses are receiving assistance? How do approaches to serving small businesses differ? To what extent do businesses require access to established and/or new state-of-the-art technologies? What type of technology extension services currently exist and what can be learned from them? Finally, what action should states take in expanding their technology assistance efforts and what role can the federal government play in supporting these efforts?

Major Findings

The current system for delivering services to small and medium-sized businesses is highly decentralized. The survey, which was not all-inclusive, identified more than 200 organizations providing direct assistance to businesses. The programs use a variety of service providers, including universities, state agencies, and private, nonprofit organizations. Universities are the most common service providers, accounting for approximately half of the programs covered in the survey.

State government is the largest funder of the programs surveyed. Total fiscal 1988 funding for all federal and state programs included in the survey was $620 million. Forty-eight percent of this funding comes from state government, with the federal government contributing approximately 26 percent.

The firms being assisted both by federal organizations and by state-supported organizations are overwhelmingly small businesses. Sixty percent of the firms being assisted by state-supported organizations have fewer than 50 employees; another 23 percent have 50 to 500 employees.

Small and medium-sized businesses require access primarily to existing off-the-shelf technology rather than to advanced state-of-the-art technology. However, both state and federal governments have concentrated their efforts on diffusing advanced state-of-the-art technology. Two-thirds of current funding for the state-supported programs is allocated to activities that support the development of new technologies—technology research centers (28 percent), seed capital programs (13 percent), and other programs (23 percent), including research and development grant programs. The federal programs in the survey tend to emphasize business assistance services, but those that support technology assistance also emphasize diffusing advanced state-of-the-art technology rather than helping firms adopt proven technologies.

The services offered by the organizations surveyed vary greatly, as does the extent to which these programs provide assistance on technological issues. Twenty-three percent of total dollars expended were allocated to technology assistance services, another 23 percent to technology research centers, and 17 percent to business assistance.

One of the main differences among the programs is that some programs act primarily as brokers, putting businesses in touch with other sources of information, while other programs provide services directly through field staff and other technical advisers. The brokering programs are clearly able to serve a larger number of businesses per year. The more active programs serve fewer clients but provide more in-depth assistance.

Programs dealing specifically with the modernization of small and medium-sized manufacturers are a fairly small component of state and federal technology initiatives. The survey identified thirteen state organizations operating specialized technology extension programs. These programs account for only 4 percent of total expenditures on development initiatives covered in the survey. There is no federal program dealing specifically with the modernization of small and medium-sized manufacturers.

While the thirteen state technology extension services differ substantially in structure, funding, and approach, they share some general principles.

- The programs emphasize client-directed problemsolving rather than pushing out new technology.
- The program managers recognize that it is difficult, if not impossible, to separate businesses' needs for different types of assistance.
- The programs emphasize the value of on-site personal field service in aiding firms.
- Extension staff must have the ability to call on a wide range of specialists and people with particular technical expertise.
- Training is a critical component of technology deployment.

Conclusions and Recommendations

The study identified a wide variety of programs providing direct assistance to small and medium-sized businesses. These programs differ greatly in the type of assistance provided and the extent to which they are designed to help U.S. manufacturers modernize—i.e., to adapt and use productivity-enhancing technologies efficiently.

Although it is not possible to assess the effectiveness of these efforts from the survey data, it is clear that some of the programs are designed to help firms modernize. Specifically, the specialized technology extension programs are trying to help firms address issues associated with technology deployment.

Our analysis of these programs leads to a number of recommendations regarding any future federal role or expanded state role in technology extension.

- *Both state and federal governments should increase their emphasis on improving and diffusing proven manufacturing technology.* State governments should examine their technology development strategies to determine the extent to which existing programs seek to assist firms to deploy technology. Federal efforts to promote technology transfer should be broadened to consider how federal resources can be used to help small and medium-sized manufacturers solve problems encountered in adopting technology.
- *Any federal effort to support technology extension activities should recognize and encourage the varied approaches being tried in the states.* Even among the small number of state technology extension programs, there is a great deal of variation. The programs differ in structure, outreach, and services provided. Federal efforts should not seek to impose a single model.
- *The federal government should consider helping states without programs initiate technology extension services while supporting and learning from the existing state programs.* This could be accomplished by establishing a matching grant program and/or funding demonstration projects designed to identify model approaches.
- *Both federal and state programs to support technology extension should consider ways to provide training as an element of the services provided.*

- *Additional research is needed to understand the way in which technology is diffused and adopted by small businesses and how this process can be facilitated.* There is little data available to measure the effectiveness of the varying approaches being tried in the states. The federal government can play an important role in identifying examples of successful programs.
- *A national network should be established* to familiarize state officials with various approaches, effective evaluation methods, innovative ideas, and minimum standards of effective performance.

Achieving technological excellence in our manufacturing sector is an important goal for the nation. State governments, working in cooperation with the federal government, can act as catalysts encouraging the diffusion and adoption of technology. In the long run, however, ways must be found to enable small and medium-sized companies to develop their own capacity to remain technologically competitive. Trade associations, vendors of technology, and manufacturing networks each have a role to play in providing support to small manufacturers. The new government programs being put in place should ultimately seek to improve the capacity of small firms to manage and deploy technology.

PROMOTING TECHNOLOGICAL EXCELLENCE: THE ROLE OF STATE AND FEDERAL EXTENSION ACTIVITIES

1. Introduction

The ability of U.S. firms to compete in world markets depends on their ability to generate new ideas and use new technology. To remain competitive, U.S. firms must continually adopt new technological processes and introduce new products. Yet indications are that U.S. manufacturers have been slow to automate and use existing technologies.

A recent study of durable goods manufacturers in the Great Lakes region revealed that "of durable goods factories with fewer than 50 employees, more than 85 percent have yet to introduce a single programmable machine tool. Only 13 percent of smaller shops use computer-aided design, and fewer than 3 percent have found a use for robots, automated inspection systems, or automated materials handling."[2]

In addition, U.S. manufacturers have often failed to commercialize and capitalize on research findings and technological breakthroughs. This failure to make the most of the nation's technological prowess has far-reaching implications affecting our standard of living and our future place in the world economy. To compete in world markets, U.S. industry must apply advanced technological design and manufacture to its products.

In response to this challenge, twenty-six states have initiated technology transfer programs that provide technological assistance to small and medium-sized businesses.[3] Such firms often lack the resources and expertise needed to apply and commercialize new industrial technologies. Given their important role as suppliers to larger firms, the failure of small firms to adopt technologies will adversely affect the competitiveness of the entire manufacturing sector.

Often these state technology extension services or technology transfer programs are elements of a comprehensive state technology development program that supports research and development, provides financing for new product and process development, training for workers, and a variety of support services for technological innovators and entrepreneurs.

In 1988, Congress passed the Omnibus Trade and Competitiveness Act. The Competitiveness Act portion of the bill was aimed at improving the ability of U.S. firms to compete in global markets. Congress called on the National Institute of Standards and Technology (NIST), formerly the National Bureau of Standards, to develop and implement a program of technology development and transfer in collaboration with industry, universities, other federal agencies, and state and local governments.

As part of this effort, NIST was instructed to conduct a nationwide study of state technology extension services and to develop recommendations for an appropriate federal role in encouraging such programs. In the fall of 1988, NIST contracted with the National Governors' Association's Center for Policy Research to conduct a nationwide survey of state and federally supported business and technology assistance programs. The study included not only technology extension programs, but also business assistance programs that may provide services to technology-based firms.

The purpose of the study was to identify the existing network of organizations providing services aimed at transferring technology, modernizing manufacturing processes, and/or improving the productivity and profitability of businesses. In addition to collecting descriptive information on state and federally supported programs—budget, staff, number and type of businesses assisted, and number and type of services provided—the study sought to assess the degree to which existing programs make use of federal programs and to identify what additional federal information and technical assistance the programs could utilize.

A survey instrument, designed to collect information on the range of state technology development programs, was designed by NIST staff. A copy of the survey instrument is contained in Appendix II.

Since no comprehensive list of state-supported programs existed prior to the survey, NGA identified a state coordinator in each of the fifty states.[4] These coordinators, appointed by their Governors to serve on NGA's Working Group on State Initiatives in Applied Research, were responsible for distributing surveys to the program managers responsible for the following program areas: business assistance, incubators, research parks, seed capital, technology assistance, and technology research centers. (See definitions.) In addition, the coordinators were given the option of completing a coordinator's version of the questionnaire on which they could provide aggregate data for a number of individual state programs.

Forty-four states and Puerto Rico responded to the survey. The following states do not provide direct state funding for the technology development program areas included in the study: Louisiana, Nevada, New Hampshire, and Vermont. Arizona and Utah did not respond. A total of 178 surveys were received from managers of state-supported programs. The number of surveys completed varied from state to state based on the number of individual programs per state and whether data was aggregated at the state level prior to being entered on the survey form. Thus the number of responses does not correspond directly to the number of state programs.

Survey forms also were sent to federal programs providing direct assistance to businesses in order to determine the extent to which these programs provide assistance to firms on technological issues. These included:

- Small Business Development Centers, a Small Business Administration program;
- University Centers, a program of the Economic Development Administration of the U.S. Department of Commerce;

Definitions

Business Assistance: Business assistance focuses on providing general business management information such as personnel, accounting, and legal advice.

Incubators: Incubator facilities provide office and law space for start-up companies at below-market rates. Shared support services such as clerical, reception, and data processing are often made available.

Research Parks: Research parks are planned groupings of technology companies that encourage university/private relationships.

Seed Capital: Money is provided for projects that are at an early stage of development or that offer job creation potential but may not have the return on investment expected by commercial venture capitalists. These include research grant and product development programs.

Technology Assistance: Technology assistance focuses on providing specialized services such as technical information, invention evaluation, technical counseling, and patent information. Technology assistance includes both information exchange and active outreach programs to provide access to newly created technologies and to promote innovative applications of established technologies.

Technology Research Centers: These centers generally concentrate their studies in a particular field usually based on the strengths of the university and/or the major industries in the state.

- Trade Adjustment Assistance Centers, a program of the International Trade Administration, U.S. Department of Commerce; and
- NASA Industrial Applications Centers.

A total of 109 surveys were sent to these centers; the survey population included a sample of Small Business Development Centers, and all University Centers, Trade Adjustment Assistance Centers, and Industrial Applications Centers. Completed forms were received from 53, a return rate of 49 percent. Table 1 shows the number of surveys mailed and returned in each federal program category.

Table 1
Federal Programs Included in Survey Population

Program	*Surveys Mailed*	*Surveys Returned*
Small Business Development Centers	48	26
University Centers	39	14
Industrial Applications Centers	10	7
Trade Adjustment Assistance Centers	12	6
TOTAL	109	53

This report is divided into six chapters. Chapter 2 presents an overview of state and federal organizations providing business and technical assistance services. Chapter 3 describes the activities and characteristics of the state programs included in the study, and Chapter 4 examines selected technology extension programs in more depth. Chapter 5 examines the federally supported programs included in the survey. Chapter 6 looks at the relationship of the programs to selected federal programs.

2. Overview

The large number of publicly supported organizations providing direct assistance to small and medium-sized firms raises questions regarding the nature and quality of the services provided; the type of businesses being assisted; the degree to which the services provided match the needs of the business community, particularly in regard to the introduction of new technological processes; and the extent to which the various programs complement one another. This chapter presents an overview of the existing network of state and federal organizations providing business and technical assistance services.

Characteristics of the Existing Network

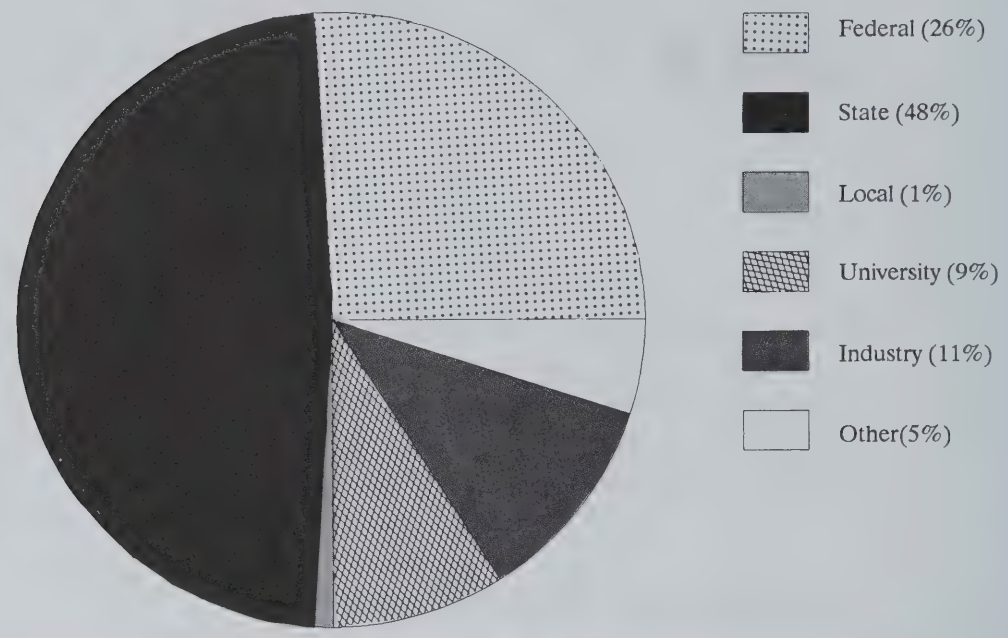
The current system for delivering services to small and medium-sized businesses is highly decentralized. The survey, which was not all-inclusive, identified more than 200 organizations providing direct assistance to businesses. The programs use a variety of service providers, including universities, state agencies, and private, nonprofit organizations. Universities are the most common service providers, accounting for approximately half of the programs covered in the survey.

State government is the largest funder of the programs surveyed. Total fiscal 1988 funding for all federal and state programs included in the survey was $620 million. Forty-eight percent of this funding comes from state government, and the federal government contributes approximately 26 percent. The remainder is contributed by industry (11 percent) and universities (9 percent). Local governments contribute approximately 1 percent.[5] (See Figure 1.)

All regions of the country are served by organizations providing direct assistance to businesses, although the type of organizations providing services and the type of services provided often differ greatly from region to region. The largest number of responses was received from the Midwest. The South accounted for the largest amount of total dollars—35 percent of total 1988 funding. The North accounted for 29 percent of spending, the Midwest for 24 percent, and the West for 12 percent. It should be noted, however, that nonresponses may have influenced these regional distributions.

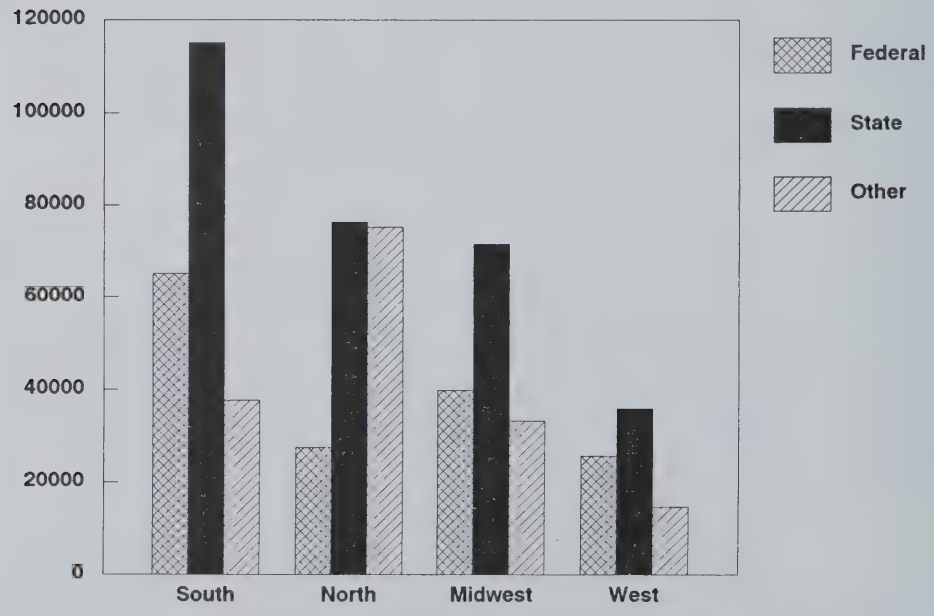
An examination of source of funds by region shows that the distribution of funds by source differs significantly. In the North, 26 percent of total funding is provided by industry, compared with 4 percent to 7 percent in the other three regions, and state funding matches federal funding at a rate of 2.8-to-1. In the South and Midwest, the ratio of state to federal dollars is 1.8-to-1 while in the West the ratio is 1.4-to-1. (See Figure 2.)

Figure 1
Funding by Source of Funds - Percentage of Funds 1988 - All Programs



SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

Figure 2
Funding by Region - Total Funds 1988 - All Programs



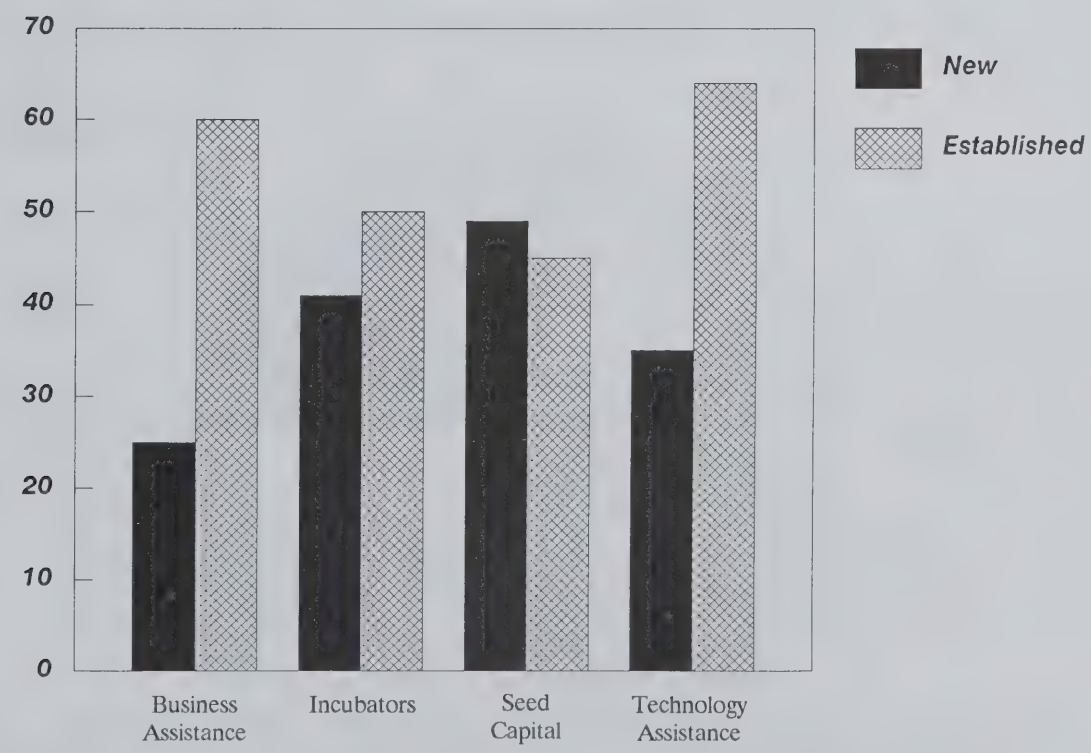
SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

Need for Access to Technology

The survey sought information on the extent to which small and medium-sized businesses seek help on technological issues. The respondents were asked to indicate the percentage of firms assisted that require access to new or established technologies. The program managers reported that one-half to two-thirds of all businesses assisted require access to established technologies, while one-quarter to one-half require access to new technologies. The exact percentage varied by program area. (See Figure 3.)

Although the respondents indicated that small and medium-sized businesses need access primarily to existing off-the-shelf technology rather than advanced state-of-the-art technology, two-thirds of current funding for the state-supported programs is allocated to activities that support the development of new technologies—technology research centers (28 percent), seed capital programs (13 percent), and other programs (23 percent), including research and development grant programs. The federal programs in the survey tend to emphasize business assistance services, but those that support technology assistance also emphasize diffusing advanced state-of-the-art technology rather than helping firms adopt proven technologies.

Figure 3
Mean Percentage of Firms Requiring Access to New or Established Technologies



SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

Services Provided

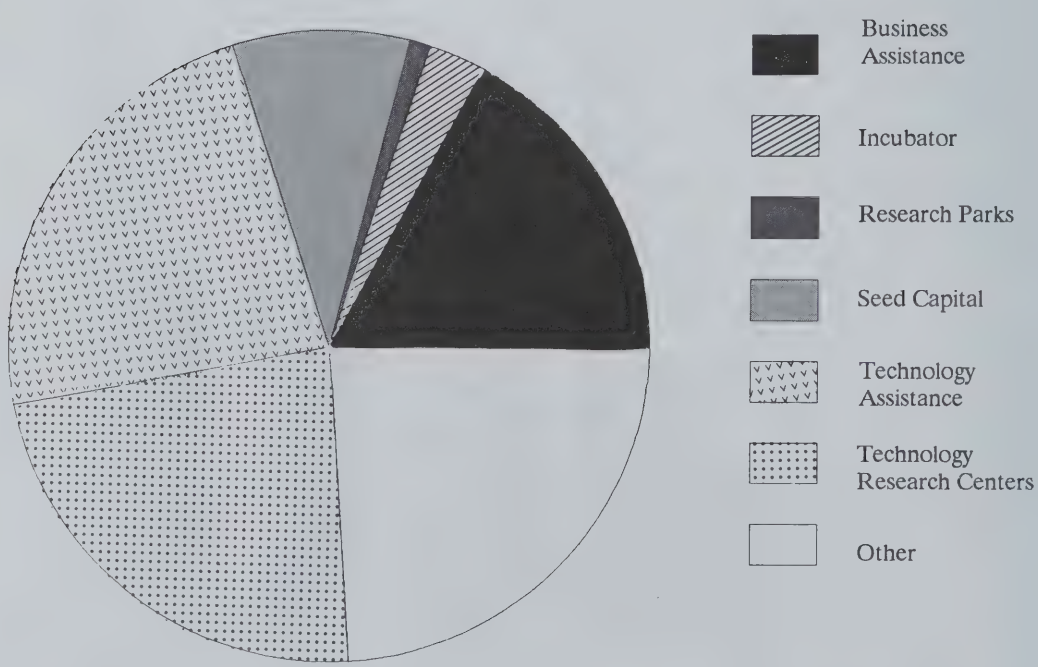
The services offered by the organizations surveyed vary greatly, as does the extent to which these programs provide assistance on technological issues. Of the $519 million allocated to specific program categories, $121 million, or 23 percent, is allocated for technology assistance services. Another 23 percent is allocated for technology research centers and 17 percent for business assistance. Twenty-four percent of total funds are allocated to other activities not covered by the survey. A majority of these funds are probably allocated to research and development grant programs. (See Figure 4.)

The majority of the organizations responding to the survey provide a range of services. Only 20 percent of the respondents reported dedicating 100 percent of their resources to a single program area.

One of the main differences among the programs is that some programs act primarily as a broker, putting businesses in touch with other sources of information, while other programs provide services directly through field staff and other technical advisers. The brokering programs are clearly able to serve a larger number of businesses per year. The more active programs serve fewer clients but provide more in-depth assistance.

In general, both the state and federally supported organizations providing primarily business assistance services—for example, SBDCs and state business assist-

Figure 4
Funding by Program Orientation - Fiscal 1988 - All Programs



SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

ance programs—serve a much higher number of clients per year than do those organizations that provide primarily technology assistance services. Business assistance services include financial analysis, management assistance, and business plan preparation.

While 167 state and federally supported organizations reported providing technology assistance services, the number of "technology extension services"—defined as programs whose primary purpose is to provide direct consultation to manufacturers for technology deployment—is much smaller. The study identified thirteen state-supported organizations in nine states that fit this more limited description.[6]

Businesses Served

The firms being assisted by both the federal and state-supported organizations are overwhelmingly small businesses. This is true regardless of the type of service being provided. Sixty percent of the firms being assisted by state-supported organizations have fewer than 50 employees. Another 24 percent have 50 to 500 employees. (See Figures 5 and 6.)

Technology assistance services are being provided at a fairly even rate to manufacturing and non-manufacturing firms. Approximately two-thirds of the firms receiving business assistance, however, are non-manufacturing firms.

Four-fifths of the organizations responding to the survey are located in metro areas.[7] Because many of the programs use field offices or regional staff, it is difficult to determine the extent to which these programs serve firms located in rural areas. It can be assumed, however, that firms in close proximity to service providers find the programs more readily accessible. The ability of these programs to meet the needs of rural businesses is a topic for additional study.

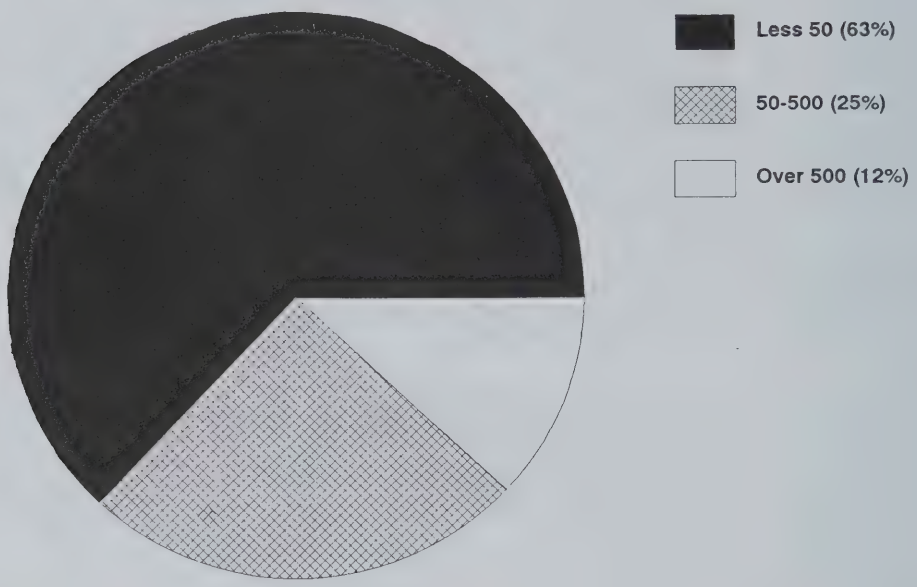
Ways to Improve the Technology Transfer Process

The program managers were asked to indicate the methods that they think are most successful in reaching and assisting small businesses. On the survey form and at the NGA roundtable, officials strongly stated the need for personal contact. Networking was the outreach strategy favored by both federal and state respondents, followed by direct solicitations and the use of field agents. State technology extension agents placed the greatest emphasis on the use of field agents to conduct outreach to client firms. (See Figure 7.)

Program managers of state technology extension services emphasized that extension services must be client-driven to be effective. The specialized technology extension services identified in the survey operate in a problem-solving mode—a technology pull as opposed to technology push approach.

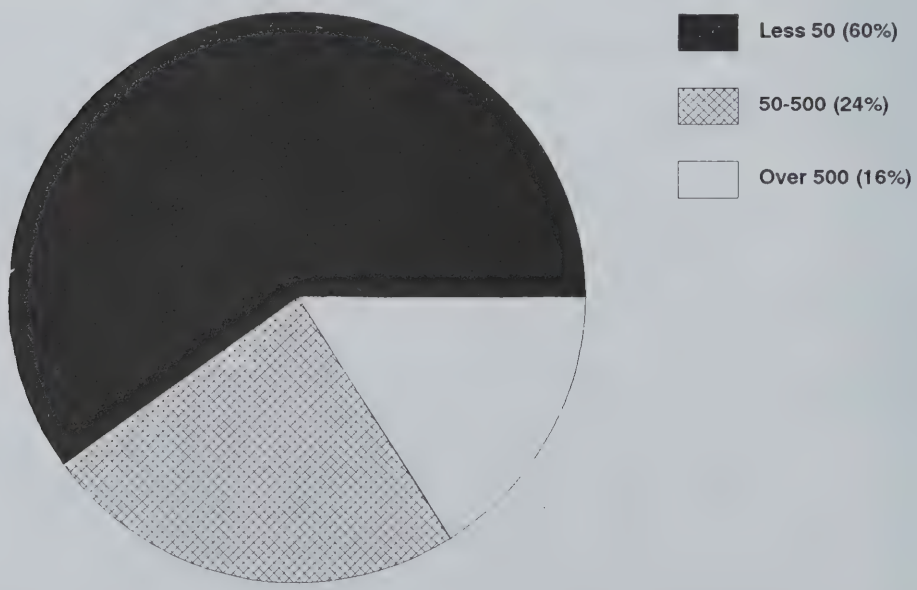
State and federal program managers agreed that for strategies to promote the transfer of federal technology, they would concentrate on cooperating actively with federal agencies in their technology transfer programs and establishing a training

Figure 5
Size of Firms Receiving Technology Assistance - State Programs



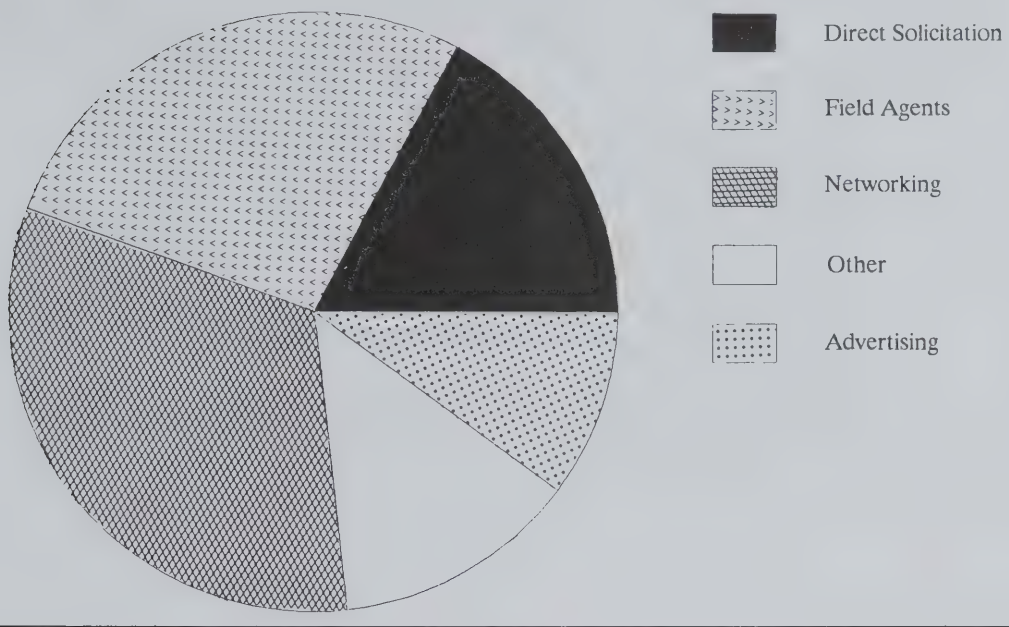
SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

Figure 6
Size of Firm Receiving Business Assistance - State Programs



SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

Figure 7
Outreach to Client Firms - Proposed Allocation of $100



SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

program at the state and local level focused on federal technology transfer and cooperation.

The state respondents placed greater emphasis on cosponsoring demonstration projects than on drawing on a federal clearinghouse to disseminate information on federal research and development, while the federal respondents favored a clearinghouse over demonstration projects. (See Table 2.)

Table 2
Strategies to Facilitate the Transfer of Federal Technology

Strategies	*Average Allocation of $100*	
	State-Supported Programs	*Federally Supported Programs*
Cooperate actively with federal agencies in their technology transfer programs	34	35
Cosponsor model demonstration projects	24	15
Draw on a federal clearinghouse to disseminate information on federal R&D	16	24
Maintain a training program at the state and local level focused on federal technology transfer and cooperation	26	26

SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

3. State-Supported Programs

State governments are actively involved in promoting economic growth within their states. During the 1980s, state economic development policies began to focus on ways to improve the productivity and competitiveness of existing firms. The survey covered two distinct sets of programs designed to achieve this goal.

First, almost every state provides management and technical assistance to small and medium-sized businesses. Such assistance may take many forms, such as helping a firm locate and secure financing or providing advice on accounting or inventory controls. Business assistance programs vary in the extent to which they help businesses with technological issues.

Second, a large majority of the states have adopted policies and programs to encourage the development and application of advanced technology by both existing and new firms.[8] For the purposes of this study, technology development initiatives include the following elements:

- incubators,
- research parks,
- seed capital,
- technology assistance, and
- technology research centers.

These categories are similar to those used in *State Technology Development Programs in the United States, 1988*, published by the Minnesota Office of Science and Technology. This report is the most frequently used catalogue of state-supported programs. One area of significant state support not included in the survey is applied research and development grant programs.

Technology transfer is often a goal of each of these program activities. In several states specialized "technology extension services" have been initiated. While it is difficult to give an exact definition of technology extension services, this study defines them as "programs whose primary purpose is to provide direct consultation to manufacturers for technology deployment." A smaller subset of programs fitting this description is described in the next chapter.

Seventy-eight percent of the state-supported programs included in the survey can be categorized as technology development programs. These programs reported total fiscal 1988 funding of approximately $465 million. Of this amount, 28 percent is allocated to technology research centers, 22 percent to technology assistance, 13

percent to seed capital, 9 percent to business assistance, 4 percent to incubators, and 1 percent to research parks. Twenty-three percent was allocated to "other" activities, which include research and development grant programs.

This distribution of funds suggests that states are emphasizing activities that support the development of new technologies—technology research centers (28 percent), seed capital (13 percent), and research and development grant programs (included in the "other" category 23 percent)—to a much greater degree than they are supporting the application of existing technology. Yet the program managers surveyed indicated that the majority of the firms they work with require access to existing technology. This could indicate that state technology strategies place greater emphasis on encouraging the growth of new firms and development of new products than on the adoption of technology by existing firms.

Fifteen percent of the state respondents operate programs that are primarily business assistance programs. These programs are included in the analysis because they provide some element of technological assistance to businesses. These business assistance programs account for $54 million in fiscal 1988 funding or 10 percent of total funding for the state-supported programs in the study. Sixty-six percent of total funding was allocated to the "other" category indicating the nontechnical nature of these programs. This category includes a full range of traditional economic development activities. Of the remainder, 26 percent is allocated to business assistance services, 5 percent to technology assistance, 2 percent to incubators, and 1 percent to technology research centers.

Thirteen responses (7 percent) were received from organizations operating specialized technology extension programs. These programs account for $26 million, 5 percent of total fiscal 1988 funding for the state-supported programs. The technology extension service program managers reported allocating 47 percent of their resources to technology assistance, 49 percent to technology research centers, 3 percent to business assistance, and 1 percent to seed capital. For a more complete discussion of the activities of the extension services, please see pages 23-29.

Although it is possible to identify programs that concentrate their resources primarily on one activity, the vast majority of the organizations responding to the survey (80 percent) provide some combination of services. For example, one organization may provide business assistance, technology assistance, and seed capital while another may provide technology assistance and operate an incubator. The next section discusses the range of services provided by all the state-supported programs within the following areas: technology assistance, business assistance, incubators, research parks, seed capital, and technology research centers.

Technology Assistance

Recognizing that the major benefits of technology development are experienced when proven advances are widely adopted and productively utilized throughout the economy, states have become increasingly active in providing technology assistance and encouraging technology transfer.

Technology transfer can be accomplished by examining existing research, actively searching for technology that has commercial application, and then assisting in the development of a process or product and associated business. It also can attempt to accelerate the diffusion of off-the-shelf technology to existing industry. The latter is usually accomplished by providing some combination of information and field service. Both types of programs are included in the survey population.

For the purpose of this survey, technology assistance was defined as the provision of specialized services such as technical information, invention evaluation, technical counseling, and patent information. It includes both information exchange and active outreach programs to provide access to newly created technologies and to promote innovative applications of established technologies.

Some 122 state-supported organizations, 69 percent of the total responding to the survey, provided detailed information on their technology assistance efforts.[9] The median number of firms assisted by these programs in 1988 was 60, though the number of firms assisted ranged from 20 or less to several thousand. This large range indicates the varying level of services provided by individual programs. In some cases, a request for assistance may be handled by a single phone call. In other programs, a firm may be provided with in-depth, on-site technical assistance as the firm seeks to adopt a new technology. On average, the number of firms for which an organization can provide technology assistance is much smaller than the number of establishments that can be provided with business assistance services. This could indicate that technology assistance services require a greater level of resources and time.

The respondents were asked to indicate the types of services provided from 1985 to 1987 and in 1988 and to identify which services would be expanded during 1988-89. Table 3 lists the services provided in 1988 in rank order. An examination of the expanded services shows that, by and large, organizations are expanding services currently being offered rather than changing the mix of services provided.

Table 3
Technology Assistance Services Provided by State-Supported Programs

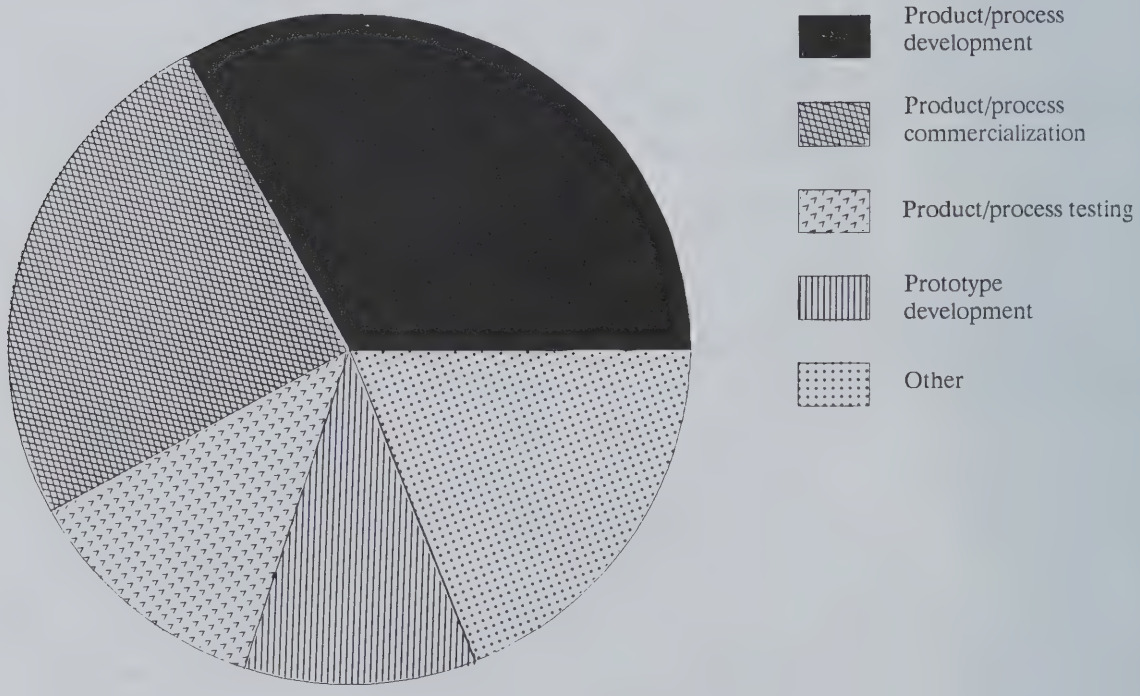
	Percent Providing Service, 1988	*Percent Expanding Service in 1988 or 1989*
Networking and Referrals	85	69
Seminars/Workshops	81	66
Technical Counseling	77	60
User Request and Response	68	52
Technical Literature Dissemination/Review	62	48
Product Design and/or Evaluation	60	43
Technical Data Services	53	41
Demonstration Projects	43	39
State Liaison to Federal Labs	43	36
Joint Venture/Partnership Counseling	39	33

SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

Ninety-four respondents provided information on the number and type of businesses served. Of the approximately 35,000 firms receiving technology assistance services, 52 percent were manufacturers and 48 percent were nonmanufacturing businesses. Most of the firms receiving technology assistance are small businesses—63 percent of the firms have fewer than 50 employees and 25 percent have between 50 and 500 employees. Only 12 percent of the firms served had more than 500 employees. This percentage is to be expected as large firms usually possess greater in-house expertise and are capable of dealing with technological issues and problems.

An average of 66 percent of the firms assisted required access to established technology, while only 37 percent required access to new technologies. This is an important finding in that most federal and many state efforts target state-of-the-art technology for technology transfer efforts. Figure 8 shows a breakdown by type of assistance provided.

Figure 8
Type of Technology Assistance Provided



SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

The large percentage of responses in the "other" category may be due to the fact that firms adopting a technology for the first time must deal with variety of issues, such as workforce training, in addition to the technology itself. Thus, many of these organizations find themselves providing a broad range of services. The majority of the responses in the other category involved assistance in modernizing or applying manufacturing technologies.

The types of technologies targeted in 1988 include: manufacturing technologies (35 percent), information sciences (15 percent), biotechnology and life sciences (15 percent), material sciences (10 percent), and aerospace and earth sciences (4 percent each).

Business Assistance

As stated previously, every state provides business assistance services to small and medium-sized firms. The organizations included in the survey represent only a small sample of these programs. However, in addition to providing business assistance, the organizations included in the survey also operate some type of technology development program.

One hundred and eighteen state-supported organizations (66 percent of the total) provided information on their business assistance activities. Of these, eighty-eight organizations provided information on the number and type of businesses assisted. These organizations assisted over 77,000 firms in 1988. Economic development organizations accounted for approximately 40,000 of these firms with each organization assisting an average of 2,664 firms per year. Organizations responsible for technology development programs assist an average of only 500 businesses per year. These data support the hypothesis stated earlier that more time and resources are needed to help firms address technological issues as opposed to business management issues.

Table 4 shows the types of services provided in 1988 and the services to be expanded in 1988-89. The most common are business plan preparation and evaluation, small business consulting, management assistance, and financial analysis. An examination of the services to be expanded in 1988-89 shows that the organizations included in the survey intend to continue to expand existing services rather than change the mix of services offered.

Table 4
Business Assistance Services Provided by State-Supported Programs

Type of Service	*Percent Providing Service, 1988*	*Percent Expanding Service in 1988 or 1989*
Business Plan Preparation/Evaluation	73	52
Small Business Consulting	72	51
Management Assistance and Studies	61	47
Financial Analysis	55	42
Feasibility Studies	47	33
Marketing Surveys	46	35
Joint Venture/Partnership Counseling	45	40
Site Location Assistance	42	29
Business Forecast	26	21
Labor Analysis	19	16

SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

With regard to the size of firms being assisted, the distribution is similar to the businesses receiving technology assistance; 60 percent had fewer than 50 employees, 23 percent had 50 to 500 employees, and 16 percent had greater than 500 employees. Unlike the firms receiving technology assistance where 52 percent were manufacturers, only 34 percent of the firms receiving business assistance are manufacturing firms.

State economic development organizations account for the majority of nonmanufacturing firms receiving assistance. These organizations report that 80 percent of the firms receiving business assistance from their organizations are nonmanufacturers, whereas the technology development organizations report that the firms receiving business assistance from them are evenly divided between manufacturing and nonmanufacturing.

Of the firms receiving business assistance, program managers report that 63 percent require access to established technologies, while only 29 percent require access to new technology.

It is difficult to determine from the survey data the level or extent of the services provided to firms on technological issues through these business assistance programs. Given the large number of businesses served, particularly by the state economic development organizations, it might be assumed that these organizations function primarily in a brokering role, referring clients to other sources of support.

Incubators

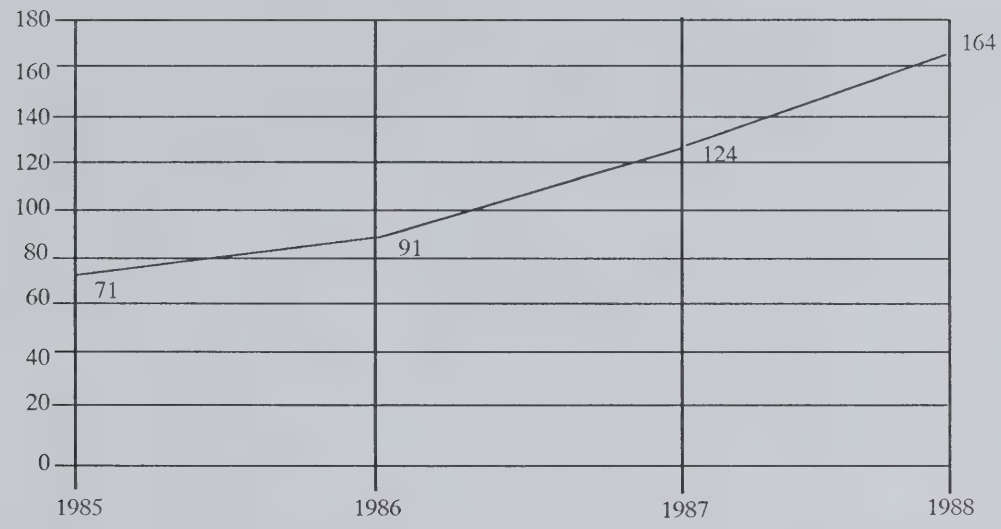
A specific tool used to support new, small business is the incubator. Incubator facilities provide low-rent office and lab space for entrepreneurs or early start-up firms. Additional on-site support services, such as office support and computer access, are also frequently provided along with on- or off-site management and technical services on a referral basis. Although incubators can serve a variety of firms, they are often developed to serve technology-based clients.

A 1988 study identified 300 business incubators in the United States. The first state programs supporting incubators was adopted in 1983. Five years later approximately half the states have programs that support the development of incubator facilities.

Thirty-seven state-supported organizations provided detailed information on incubator operations. Of these, seven were economic development organizations, and thirty were technology development organizations. Data was provided on 164 incubators. As shown in Figure 9, the number of incubators more than doubled between 1985 and 1988.

A 1985 survey of business incubators, which was not limited to those targeted to technology-based firms, found that almost twice as many firms survive to move out of an incubator as fail while there. "Thus initial comparisons with the general business environment where roughly four times as many firms fail as succeed during their first five years, are favorable."[10] For those incubators covered in the survey, the average number of jobs per incubator was thirty-two. On average, each incubator facility housed approximately six establishments with an average size of five employees per

Figure 9
Total Number of Incubators



SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

firm. A 1988 survey of incubators conducted by David Allen and Mary Ann Dougherty found a somewhat higher level of job creation. Their survey of 127 incubators yielded an average of 85 jobs per facility and 8.5 jobs per tenant.[11] This difference may be due to the fact that the incubators included in the NGA survey are more likely to be targeted to technology-based businesses with fewer employees per firm.

The average number of years a firm spends in an incubator is three. Most incubators limit the time a firm can remain in the incubator to four years. The incubators reported 367 graduates (i.e., firms that went on to move out of the incubator). Of these, the respondents indicated that 91 percent are still in business.

The respondents indicated that an average of 55 percent of the businesses located in the incubators require access to established technologies, while 45 percent require access to new technologies. As compared to other program areas, the businesses in incubators appear to have a greater need for access to new technologies. This may be a result of the fact that incubators are focusing on new, technology-based firms.

What we are not able to determine from the survey is the exact nature of the services being provided in the incubators, or the extent to which incubators are targeting technology-based businesses or assisting businesses with technological needs. It is known that many incubators target technology-based firms, and in fact the program managers reported that 55 percent of the firms in the incubators require access to new technologies. The three major technologies, targeted by the incubators

in the survey are: information technologies, manufacturing technologies and biotechnology and life sciences.

Research Parks

Often affiliated with universities, research parks have been established throughout the country to stimulate the growth of technology-based businesses. Such parks often encompass a broad array of private research firms and, on occasion, light manufacturing facilities. A recent study of research parks reports that since 1982 there has been nearly a 300 percent increase in the number of parks in the United States. The authors suggest that such growth is likely to continue. There are now approximately 130 research parks nationwide.[12]

Although many states participate in the development of research parks, few states have established programs to establish and manage them. One exception is South Carolina where the South Carolina Research Authority (SCRA) is developing a statewide research park system. Established in 1983, the SCRA has acquired and developed land for research parks in three locations throughout the state. Several other state technology programs support one or more research parks.

Sixteen state-supported organizations provided information on 27 research parks. The average number of establishments per park in 1988 was six, with an average of twenty-seven employees per park. In 1988 the program managers reported an average occupancy rate of 41 percent. Although care must be taken in drawing conclusions from such a small sample, the data seem to support the contention of Goldstein and Luger that we are perhaps overbuilding research parks. They suggest that regional economic conditions, the presence of major research universities, the cooperation and long-term commitment of local leaders, and good fortune are all factors that determine whether parks become successful.[13]

Another area that has not been examined is the role that research parks play in transferring technology to businesses. While it is possible that the location of research parks on university campuses may lead to greater interaction between businesses located in the park and university researchers, no data has been collected to indicate that this is so.

Seed Capital

States have become increasingly active in providing start-up and early stage financing for new technology-based businesses. Very early stage financing is often referred to as "seed" capital. An entrepreneur who has developed a new process, product, or service often needs such financing to support activities involved in proving a technology concept from a business point of view. Start-up capital is essential for further product development and refinement prior to commercial scale production and marketing and to begin initial market testing.

It is difficult to say definitively how many states support seed capital programs. A recent study of state competitive research grant programs prepared by the National Governors' Association identified approximately 50 research grant programs operating in more than half of the states. The report notes:

> ...27 percent of the programs [included in the competitive research grant study] identified seed capital as an activity they support; 11 percent of the programs support seed capital activities exclusively. But 71 percent of the programs support activities that would be considered traditional seed capital activities (i.e., business plan development, prototype development, and business operations).[14]

Forty-three program managers provided information on state-supported seed capital programs. Total funding for these programs was reported as $41 million in public funds and $59 million in private funds. These programs assisted approximately 1,300 firms in 1988. One-third were manufacturing firms and two-thirds were non-manufacturing firms. As might be expected, the vast majority of these firms are very small—88 percent had fewer than fifty employees. What is surprising is that firms with greater than fifty employees also received "seed capital." Although this would seem to be a contradiction in terms, one explanation is that some of this funding was used by established companies to support new product or process development.

The program managers reported that 89 percent of the businesses assisted are still in business. Of the firms receiving seed capital, 55 percent require access to new technologies and 48 percent require access to existing technologies.

The respondents reported that 36 percent of their 1988 funds were used for product and process development, 28 percent for product and process commercialization, 13 percent for prototype development, and 8 percent for product and process testing. Fourteen percent was used for other activities.

Program managers reported targeting 30 percent of their 1988 funds to manufacturing technologies, 20 percent to information technologies and 18 percent to biotechnology and life sciences.

Technology Research Centers

Often called centers of excellence or advanced technology centers, technology research centers are vehicles for conducting research in a specific technological area. Usually, the state identifies those areas in which the university system has expertise or those that are particularly pertinent to the state's major industries. A research center is established to focus efforts on these targeted technologies with the state serving as a catalyst to bring the resources of the private sector and the university together.

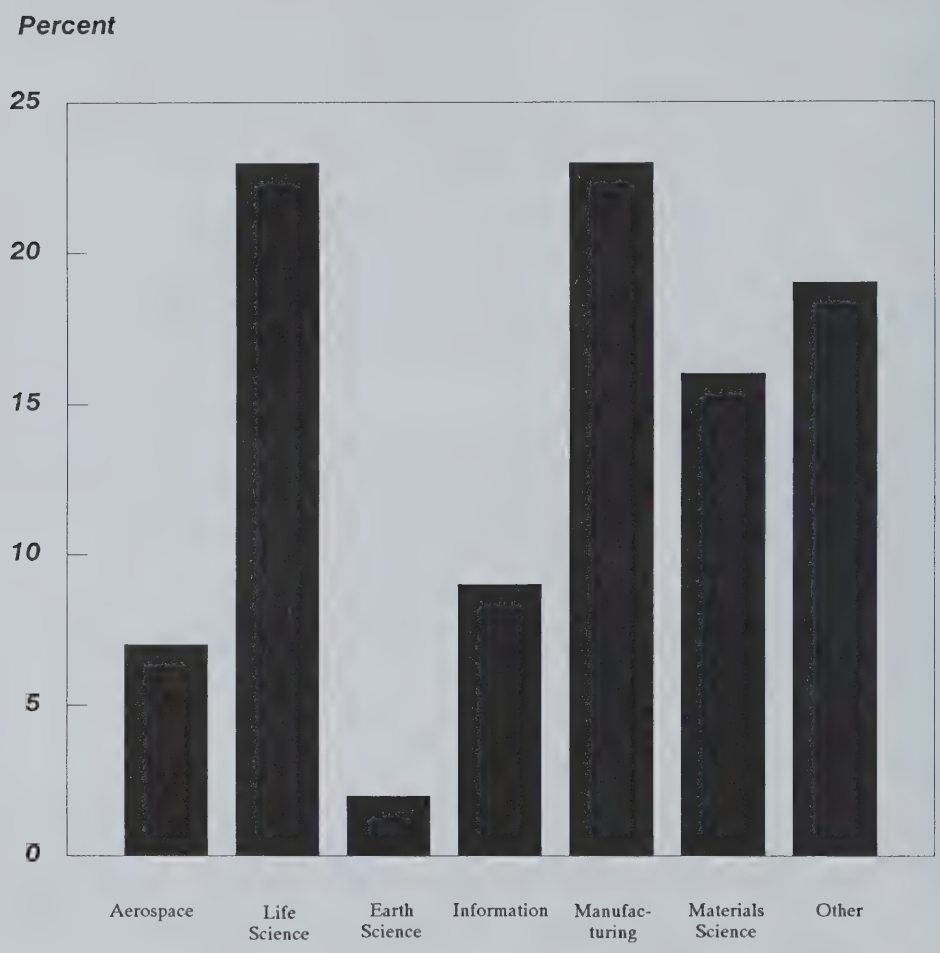
Technology research centers can be designed to attract new industry to a state, to encourage the creation of new firms through spin-off of new products and processes, or to help solve the technological problems of existing industries. A 1988 study prepared by LFW Management identified approximately 100 state-supported centers of excellence.[15]

Forty-one state-supported organizations provided data on technology research centers. These organizations supported 137 centers in 1988. The largest concentration of centers is in the Midwest with 53, followed by the South with 34, the West with 29, and the North with 21. The program managers reported that nearly

2,000 firms are participating in these 137 centers. Over half of these firms are small and medium-size companies; four-fifths of these are manufacturers.

Figure 10 shows a breakdown of the technologies targeted by the technology research centers included in the survey.

Figure 10
Mean Targeted Technologies - Technology/Research Centers



SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

4. Specialized Technology Extension Programs

While the state programs described previously may contribute to technology transfer, the vast majority of them pursue this objective as only one of many. In many cases, technology transfer is not the primary objective of these organizations. A much smaller subset of state programs has evolved whose primary function is to help small and medium-sized businesses, particularly manufacturers, adopt advanced technologies. These programs have come to be known as "state technology extension" programs.

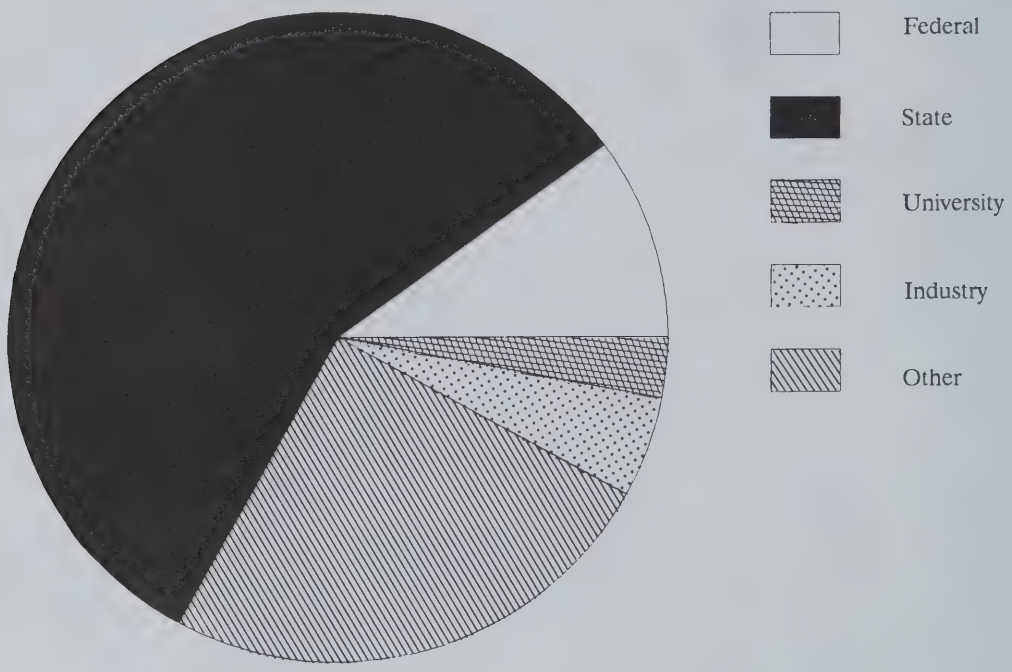
Based on an examination of organizational objectives, thirteen organizations were identified that operate state technology extension programs. In two cases, the Industrial Extension Service at Georgia Tech and the Michigan Modernization Service, the extension service is housed in an organization with additional responsibilities for technology development. This chapter discusses the data provided by these organizations and also provides descriptions of sample programs.

As stated previously, state technology extension programs accounted for only 4 percent ($25 million) of total expenditures in the range of development initiatives covered in the survey.[16] It should be noted, however, that half of this amount ($12.4 million) was expended by one organization, the Michigan Industrial Technology Institute (ITI). Forty-nine percent of these funds support technology research centers, 47 percent support technology assistance services, 3 percent support business assistance activities, and 1 percent support seed capital programs. If ITI is excluded, however, the amount allocated to technology assistance increases from 47 percent to 75 percent and the amount allocated to technology research centers decreases substantially from 49 to 17 percent. Budget size ranged from $450,000 to $12.4 million annually. With the exception of ITI, most budgets fell within the $500,000 to $1.5 million range.

State governments are providing 45 percent of the funding for these extension programs with another 13 percent coming from universities, 12 percent from industry, 7 percent from the federal government, and 22 percent from other sources. It is likely that the "other" category represents fees and contracts for services provided. Once again, however, the size of the ITI budget skews the figures to some extent. If ITI is excluded, funding from state government increases from 45 percent to 57 percent, the university share doubles increasing from 12 to 25 percent, and the other category decreases from 22 to 3 percent. The industry and federal government contributions decrease to 5 and 3 percent respectively. (See Figure 11.)

The programs range in staff size from 1 to 122. For the majority of the programs the staff is small, averaging about 20. Overall, the program managers reported

Figure 11
State Technology Extension Services - Funds by Source Fiscal 1988



SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

providing assistance to 5,029 firms in 1988. More than three-fourths of these firms, however, are served by two programs, the Ohio Technology Transfer Organization (OTTO) program, and the Pennsylvania Technical Assistance Program (PENNTAP). The remaining programs typically served from 150 to 250 clients per year. This wide range in the number of businesses served may reflect the different approaches employed by these programs. Some of the programs act primarily in a broker's role matching businesses with various resources. Others take a more active role, with staff providing one-on-one consulting services.

There appears to be no relationship between staff size and the number of firms served, which ranged from 3.3 to 66.6 clients per staff person. Nor is there a relationship between budget size and number of firms served. This may be due to the fact that the budget may fund additional nonextension activities or may reflect differences in the level and depth of service provided. One program funded at $3.2 million reported assisting 180 businesses in 1988, another funded at $1.5 million reported assisting 3,000 firms.

There does appear to be a relationship between staff size and the type of services provided. On-site assistance requires a larger staff, or a small staff with a number of outside consultants or faculty members to draw on. Programs that primarily respond to technical questions and provide resource referral services require fewer staff.

Given the wide variation in the programs covered by the survey, the best way to assess the range of services provided and businesses served and to understand the variations in approach is to examine the characteristics of individual programs. The following program descriptions draw on the survey data, research conducted by Philip Shapira of the University of West Virginia, and information supplied directly by the managers of the individual programs.

Industrial Extension Service at Georgia Tech

Established in 1956, the Industrial Extension Service (IES) is one of the oldest technology extension programs. Using a network of regional offices and field staff, the service provides manufacturers and local communities with information and technical assistance on new technologies, management tools and techniques, and access to problemsolving engineering skills.

A firm interested in securing services through the IES usually contacts a regional office. An initial site visit to the firm is used to collect information about the business including data describing production methods, management structure, and financial conditions. The IES staff can provide recommendations themselves or utilize the expertise of Georgia Tech's faculty and research centers. Technical assistance is not limited to engineering questions; staff members have business problemsolving experience and diverse industrial backgrounds.

The IES encompasses the Southeastern Trade Adjustment Assistance Center, an EDA University Center, and an Apparel Manufacturing Technology Center supported by the Defense Logistics Agency. Total funding for all of these programs was $12.2 million in 1988. Approximately $2.5 million is used exclusively for the extension service. In 1988 IES provided business assistance to nearly 900 firms, 80 percent of which were manufacturers. Nearly all had fewer than 500 employees. Technology assistance was provided to 1,500 firms, 90 percent of which were manufacturers. Seventy-six percent had fewer than 50 employees and 23 percent had 50 to 500 employees.

Maryland Technology Extension Service

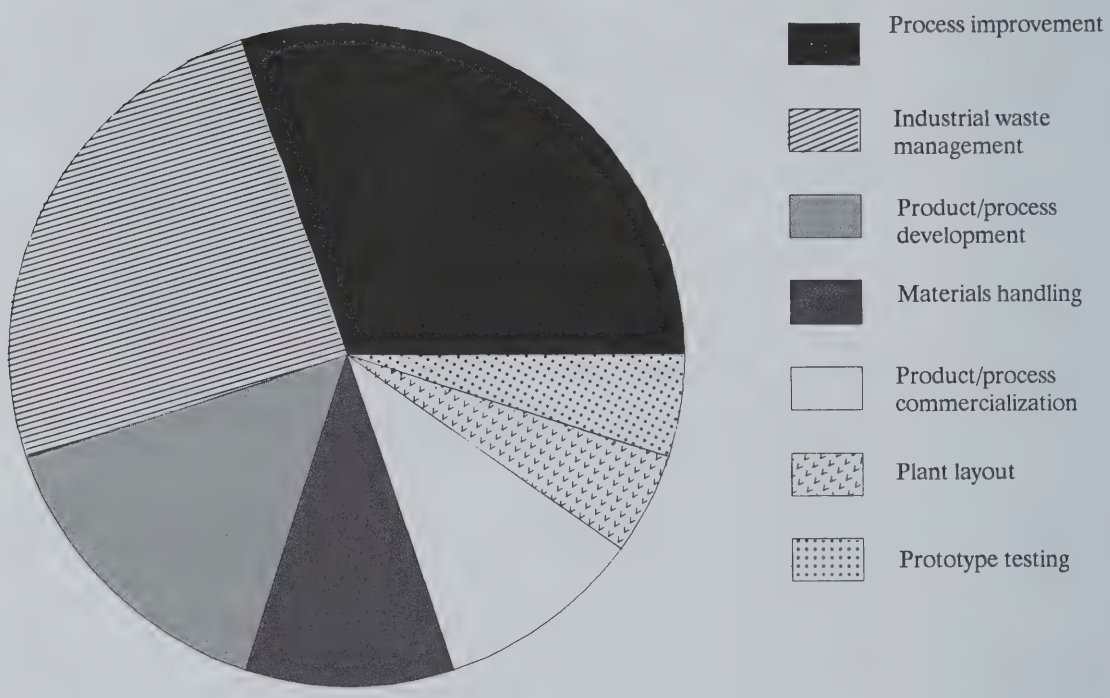
Maryland's Technology Extension Service (TES) is similar to Georgia's IES. Part of the Engineering Research Center of the University of Maryland, the program was established in 1984. The role of TES is to provide appropriate assistance in all areas of technology to all Maryland firms on request. Working through five regional offices, TES can address company problems using regional staff expertise, staff of the Engineering Research Center, university faculty, or other outside resources. The offices are staffed by industrially experienced engineers who respond to companies, providing individual technical advice and problemsolving. The TES provides up to five days of free support per problem.

Fiscal 1988 funding was approximately $550,000. TES assists an average of 300 firms per year. Most are small and medium-sized manufacturers. Of the 300 firms assisted in 1988, 270 (90 percent) were manufacturers. The program manager

reported that about 90 percent of the firms assisted require access to established technologies, 10 percent require access to new technologies.

Figure 12 shows a breakdown by type of assistance provided.

Figure 12
Maryland Technology Extension Service - Service Provided



SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

Michigan Industrial Technology Institute

Michigan Industrial Technology Institute (ITI), an independent nonprofit center, has created a multi-faceted program for technology development, technology deployment, and training designed to encourage the adoption of productivity enhancing technologies in the durable goods industry. ITI focuses on the design and operation of the factory of the future.

ITI offers its clients a variety of services including research and development, applications engineering, strategic and technical consulting, evaluation and testing, training, and information services. A number of these services are provided by ITI on a fee-for-service basis.

ITI was established in 1982. Fiscal 1988 funding included $4 million in state funding, $2.4 million in industry funding, $600,000 in federal funding, and $5.4 million in other funding (largely contracts with industrial clients). Twenty percent of ITI's budget is allocated to technology assistance, the remainder is allocated to the institute's multiple research centers. In 1988 ITI provided technology assistance to

approximately 150 firms, all of which were manufacturers. Ninety percent of this assistance was in the area of product and process development, the remaining 10 percent was for product and process commercialization.

Michigan Modernization Service

Established in 1985, the Michigan Modernization Service (MMS) is a program of the Michigan Department of Commerce in partnership with the Industrial Technology Institute described previously. The MMS provides direct consultations to small and medium-sized manufacturers in the areas of technology deployment, workforce development, and market analysis. This consultation includes a basic assessment of the firm's manufacturing operations, and their technology, training, and market needs. The initial assessment makes use of a highly detailed computer-assisted phone interview protocol.

After the initial assessment, an on-site visit is conducted. Following the visit, MMS staff develop a detailed report with recommendations and references. A follow-up meeting is held with the firm to develop an implementation plan.

A unique aspect of the program is the integral role of training. MMS visits to firms are always made by a team that includes an expert in the training area. All recommendations developed for firms also include a training component.

With total fiscal 1988 funding of $3.2 million, the program employs forty-eight staff, twenty-eight of whom are technical, twenty business, and seven support. In 1988 the program served 180 manufacturing firms; in 1989 the program expected to handle 300 clients. A client receives an average of approximately eleven days of in-depth assistance.

The program manager reported that, for the most part, the firms assisted by the program require access to off-the-shelf technology.

Pennsylvania Technical Assistance Program

Established in 1965, Pennsylvania's Technical Assistance Program (PENNTAP) helps business and industry overcome operational engineering, scientific, and technical problems that affect both stability and competitiveness. PENNTAP is operated by Pennsylvania State University.

It employs full-time professionally trained and experienced technical specialists who provide personalized attention to each problem. The staff also includes technical librarians who operate PENNTAP's Library Information System. From their own knowledge or from the many scientific and technical resources available to them, technical specialists offer solutions that represent current and proven information.

With thirteen professional staff, eleven technical and two business, PENNTAP had a 1988 budget of $1.3 million. Two-thirds of its budget comes from the university, approximately 20 percent is provided by the state, with the remainder provided by the federal government. PENNTAP serves approximately 1,000 firms per year, 75 percent of whom require access to established technologies.

The following types of services are provided:

- productivity improvement 45 percent
- product and process development 25 percent
- product and process testing 15 percent
- prototype development 10 percent
- product and process commercialization 5 percent

Unlike some of the other extension programs, PENNTAP provides no business or management assistance to their clients. Firms needing this type of assistance are referred to other sources.

Pennsylvania Industrial Resource Centers

In 1988, Pennsylvania initiated a new Industrial Resource Centers (IRCs) program designed to transfer both known and advanced technology to small and medium-sized manufacturers. Unlike many other extension services, the program is not university-based. IRCs are independent nonprofit corporations managed by private industry professionals. The IRCs form one statewide manufacturing network. Working together they make the best resources available to all manufacturers in the state. The goal of the IRCs is to strengthen Pennsylvania's traditional and emerging manufacturing industries. IRCs provide a variety of services to help manufacturers learn about, identify, and implement modern manufacturing philosophies, techniques, and technologies. This includes integrating computers into manufacturing processes, improving quality control and production planning, utilizing statistical process control and just in time inventory controls, and providing specialized training for workers.

The program is funded by the state at $10 million a year for three years. These state funds must be matched by nonstate sources on a 1:1 basis. Nine IRCs have been established, eight of which are assisting traditional manufacturing industries. The ninth, an innovative bioprocessing center, is a pilot plant to help Pennsylvania's emerging biotechnology firms. These centers are eventually expected to become self-supporting. During the first year of operation, the centers have assisted approximately 500 Pennsylvania manufacturers.

New Jersey Technology Extension Center

The New Jersey Commission on Science and Technology has established a series of technology extension centers (TEX) in four technological areas. They include:

- The John P. Caufeild Technology Extension Center for Investigative Cancer Research. The primary focus of this TEX center is to develop partnerships among industry, hospitals, clinics, and physicians to facilitate technology transfer.
- New Jersey Polymer Extension Center. The Polymer TEX Center provides assistance to New Jersey's polymer firms to resolve and prevent technical problems regarding materials selection, process engineering, and quality control. In addition, the center seeks to accelerate the application of advanced technology to the state's polymer processing industry.

- Technology Extension Center in Information Sciences. This TEX center aids New Jersey businesses in the areas of computers and telecommunications by providing training, reference resources, demonstration and testing facilities, and the extension services of a full-time professional staff and subject matter experts, primarily drawn from the faculties of the New Jersey Institute of Technology, Stevens Institute, and other New Jersey colleges and universities.
- Fisheries and Aquaculture Technology Extension Center. This TEX center aims to improve the productivity of industrial and natural systems used by the state's fisheries and aquaculture industries. The center both conducts and transfers applied and basic research.

Each center receives approximately $500,000 in annual funding from the commission. During 1988, the four centers served nearly 600 businesses, with each center serving between 100 and 200 clients.

New York State Industrial Innovation Extension Service

The New York State Industrial Innovation Extension Service (IIES) was established by the New York Science and Technology Foundation in 1983. The program provides established, small manufacturing business with knowledge, attitudes, and skills so they can address issues concerning technology-based productivity improvements. Services are provided through five regional organizations operating under contract to the foundation. Staff of these regional offices provide assistance to companies to research, evaluate, and implement opportunities for technology and productivity-related improvements.

In the initial stages of the program, the IIES works primarily with manufacturing firms in need of newer, more efficient processes and product development technologies. Management assistance, worker training, and other assistance also can be requested by clients. In these situations, the field representatives act as brokers, referring clients to appropriate local organizations that can provide the needed service.

Total funding for the IIES program in 1988 was $781 million, of which $500 million was provided by state government. The remainder was provided by universities ($112 million), local governments ($69 million), and other sources ($100 million). IIES assisted 200 manufacturing firms in 1988, over 90 percent of which had fewer than 500 employees. Eighty percent of the services were directed to helping companies use existing technology.

Ohio Technology Transfer Organization

Part of Ohio's Thomas Edison Program, the Ohio Technology Transfer Organization (OTTO) program provides Ohio businesses with direct access to new technology and research through a statewide network of thirty-four technology transfer agents based at two-year colleges.

The primary services and activities of OTTO are to:

- Provide one-on-one confidential, technology-related services to Ohio businesses;
- Forecast and identify strategic manufacturing-related technologies crucial to the enhanced productivity of Ohio businesses;
- Assist Ohio businesses in applying strategic technologies considered essential to their future growth; and
- Provide engineering, research and development, and business management problemsolving assistance to Ohio businesses.

OTTO agents work with businesses to determine a company's specific needs and then act as a liaison with a variety of government and education resources throughout the state. In this sense, OTTO is a brokering program, though agents maintain ongoing relationships with companies assisted.

The program was funded at $1.5 million in 1988, all of which is provided by the state. Of the 3,000 firms assisted in 1988, approximately 40 percent were manufacturers and 90 percent had fewer than 50 employees. Ninety-one percent of these firms required access to existing technologies.

5. Federal Technology Extension Programs

The federally supported programs responding to the survey received approximately $73 million in fiscal 1988. Of this amount, 46 percent of the funds were from the federal government, 22 percent from state government, 18 percent from universities, 7 percent from industry, 2 percent from local government, and 4 percent from other sources. (See Table 5.)

Table 5
Federal Extension Activities: Fiscal 1988 Funding by Source of Funds* (in thousands)

	SBDC	*University Center*	*IAC*	*TAAC*	*Total*
Federal Government	$19,173	$4,945	$5,057	$5,807	$34,982
State Government	8,152	7,774	95	0	16,021
Local Government	1,477	104	0	100	1,681
University	10,640	826	1,658	160	13,284
Industry	478	2,503	1,483	419	4,883
All Other	1,981	47	904	110	3,042
Total	$41,901	$16,199	$9,197	$6,596	$73,893

NOTE: *Includes total funding for the survey respondents only.

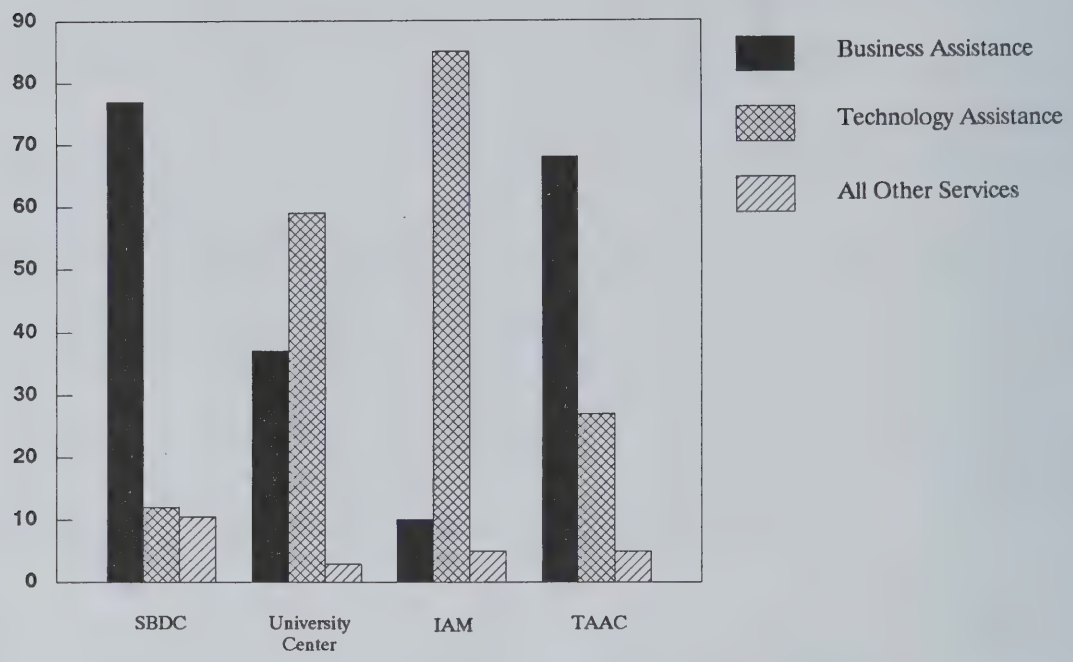
SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

Business assistance services (58 percent) and technology assistance services (34 percent) accounted for 92 percent of federal extension program budgets. The survey found that incubators, research parks, seed capital, and technology research centers jointly received only 8 percent of total funds.

As shown in Figure 13, Small Business Development Centers (SBDCs), and Trade Adjustment Assistance Centers (TAACs) provide primarily business assistance services, while IACs—and to a lesser degree University Centers—concentrate on providing technology assistance services. The largest program in terms of total funding is the SBDC program, $40 million in fiscal 1988. (See Table 6.)

The federal programs provided business assistance services to more than 74,000 establishments and technology assistance to more than 13,500 establishments in 1988. SBDCs serviced the majority of these firms, accounting for 95 percent of the firms receiving business assistance and 56 percent of the firms receiving technology assistance.

Figure 13
Program Orientation - Percentage of Funds - Federal Programs



SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

Table 6
Federal Extension Programs: Total Fiscal 1988 Funding Levels (in millions)

	Total Fiscal 1988 Program Funding	*Federal Funds Reported by Survey Respondents**
SBDCs	$40.0	$19.1
University Center	4.8	4.9
NASA IAC	3.3	5.0
TAAC	12.8	5.8
Total	$60.9	$34.8

NOTE: *May include federal funds from other sources.

SOURCE: National Governors' Association, 1989.

As with the state programs, the federal programs concentrate on small business. Approximately half of the firms receiving assistance had fewer than fifty employees. Only 18 percent of the firms receiving business assistance and 41 percent of those receiving technology assistance were manufacturing firms. (See Table 7.)

Table 7
Establishments Assisted—Business Assistance

	SBDC	*University Center*	*IAC*	*TAAC*
Manufacturing	11,407	1,486	393	260
Nonmanufacturing	57,985	1,333	169	0
Unknown	1,267	48	111	0
Less than 50 employees	36,504	2,380	605	94
50-500 employees	4,065	471	60	156
More than 500 employees	843	16	3	10
Unknown employees	29,247	0	5	0
TOTAL:	70,659	2,867	673	260

SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

Table 8
Establishments Assisted—Technology Assistance

	SBDC	*University Center*	*IAC*	*TAAC*
Manufacturing	1,380	2,395	1,722	80
Nonmanufacturing	5,874	369	1,361	0
Unknown	284	37	44	0
Less than 50 employees	3,948	2,150	1,408	19
50-500 employees	638	570	913	57
More than 500 employees	2,127	44	722	4
Unknown employees	825	37	84	0
TOTAL:	7,538	2,801	3,127	80

SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

Small Business Development Centers

Small Business Development Centers (SBDC) are partnerships between the Small Business Administration (SBA), state and local government, the educational community, and the private sector. The SBDC serves as a one-stop assistance center for businesses and provides services ranging from prebusiness start-up counseling to technical advice for existing businesses.

The SBDC mission is to serve as a vehicle for up-to-date counseling, training, and research assistance in small business management. In addition, the SBDCs have

a legislative mandate to assist in technology transfer, make use of federal laboratories and equipment, and coordinate and conduct research they deem worthwhile.

Currently, there are fifty-three lead SBDCs. These serve as the state coordinating SBDC and were utilized for the survey. (Texas and New York have more than one lead agency.) These lead agencies oversee more than 500 sub-center SBDCs across the country. In fiscal 1988, federal appropriations totaled $40 million. That figure was increased to $45 million in fiscal 1989.

The Rhode Island Small Business Development Center (RISBDC), located at Bryant College, is typical of SBDCs. Founded in 1982, the center has fifteen staff members, almost half of which are business and the rest are technical (13 percent) and support (40 percent). Most of their efforts are in the area of business assistance. The RISBDC provides free consulting, low-fee training, and related business development services to small state businesses. These services, which are offered at five offices throughout the state, are often provided by private consultants who work with RISBDC on a case-by-case basis. The RISBDC also has reached beyond its professional management assistance to provide specialty programs in export assistance and the Small Business Innovation Research (SBIR) Program. Eighty percent of the firms assisted were manufacturers and 100 percent have fewer than 50 employees. Of the establishments assisted by RISBDC, 70 percent were small nonmanufacturing firms.

Responses were received from twenty-six of the state coordinating small business development centers. These programs received a total of $43 million in funding in fiscal 1988 from the following sources: federal government $19 million, state government $8 million, local government $1 million, university $10 million, industry $500,000, and other $1 million. Thus the SBDCs receive approximately the same amount of funds from the federal government as they receive from state, local, and university sources combined.

The SBDCs allocated an average of 77 percent of their funds ($30 million) to business assistance services. SBDCs accounts for 73 percent of total federal program funds allocated toward business assistance.

The remaining SBDC funds are directed toward technology assistance (22 percent), incubators, technology research centers and research parks (1 percent each), and other efforts (5 percent). There is some question as to the nature of the technology assistance provided by SBDCs. In reality there is probably a great deal of variety in the extent to which individual SBDCs provide assistance on technological issues.

In 1988 the SBDCs responding to the survey provided business assistance to over 70,000 firms, technology assistance to approximately 7,500 firms, and assistance in obtaining seed capital to over 3,800 firms. The large number of clients receiving business assistance from SBDCs, an average of 2,700 clients per year per SBDC or approximately 100 clients per professional staff member, suggests that the majority of requests for assistance are handled with a minimal amount of resources. The average budget of a SBDC was $1.7 million in fiscal 1988. The number of businesses assisted may be somewhat inflated if, as has been suggested, every telephone call is counted as one client assisted.

SBDC involvement in the provision of seed capital is unclear. It is possible that many of the firms listed on the survey as receiving seed capital were actually given assistance in locating sources of seed capital.

In terms of the breakdown between manufacturing and nonmanufacturing clients, SBDCs provided services to four times as many nonmanufacturing clients as manufacturing clients. This was true for both business assistance and technology assistance.

The size of firm assisted by SBDCs varies depending on the type of service provided. The business assistance efforts of the SBDCs appear to be concentrated on smaller businesses (those with less than 50 employees), but about 40 percent of the businesses assisted are of unknown size. SBDCs provided business assistance services to more than 3,600 clients with less than 50 employees, more than 400 mid-sized companies (50 to 500 employees) and more than 800 large companies (more than 500 employees). Technology assistance services were provided to more than 3,900 small firms, more than 600 mid-sized firms, and more than 2,100 large firms. The number of large companies receiving assistance is somewhat surprising as one would assume that larger firms with greater staff capacity would seldom need assistance on technical and management issues. It may be that certain types of services offered by SBDCs (e.g., information on applying for financial assistance) are of help to larger firms.

Of the services listed in Table 7, at least 70 percent of the SBDCs provided each service (with the exception of labor analysis, which received low-percentage marks among both state and federal programs). Management assistance and business plan development are provided by 100 percent of the SBDCs, while marketing surveys, small business consulting and financial analysis are provided by 96 percent of the SBDCs. (See Table 9.)

Table 9
Business Assistance Services Provided by Federal Programs

	Percent Providing Services in Fiscal 1988			
Type of Service	*SBDC*	*University Center*	*IAC*	*TAAC*
Business Forecasting	70	45	25	33
Business Plan Preparation/Evaluation	100	73	25	100
Feasibility Studies	87	82	100	83
Financial Analysis	96	73	25	100
Joint Venture/Partnership Counseling	87	36	25	17
Labor Analysis	39	27	25	33
Management Assistance and Studies	100	100	75	100
Marketing Surveys	96	73	75	100
Site Location Assistance	78	73	75	33
Small Business Consulting	96	91	100	100

SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

In terms of technology assistance, SBDCs appear to act as facilitators rather than active participants. The technology assistance most commonly provided by SBDCs are seminars and workshops (100 percent), networking (96 percent), technical consulting (74 percent), and product design assistance (70 percent). Assistance such as demonstration projects (17 percent), state liaison (39 percent) and technical literature (52 percent), were less frequently provided. (See Table 10.)

Table 10
Technology Assistance Services Provided by Federal Programs

	Percent Providing 1988			
	SBDC	*University Center*	*IAC*	*TAAC*
Demonstration Projects	17	45	29	0
Joint Venture/Partnership Counseling	65	18	14	17
Networking & Referrals	96	91	100	33
Product Design and/or Evaluation	70	73	71	66
Seminars/Workshops	100	91	86	17
State Liaison to Federal Labs	39	45	86	0
Technical Counseling	74	91	86	66
Technical Data Services	57	82	100	33
Technical Literature Dissemination/Review	52	64	100	33
User Request and Response	61	82	86	50

SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

The establishments assisted by SBDCs required little access to state-of-the-art technology. In instances where business assistance was provided, an average of only 12 percent of the establishments required access to new technology while 49 percent required access to established technologies. When technology assistance was provided, an average of 27 percent required access to new technology and 49 percent to established technologies.

University Centers

The University Centers program of the Economic Development Administration (EDA) provides funds to involve the resources of universities in economic development in the community. Funding is provided to establish or augment centers that provide economic development technical assistance. Top priority is given to projects assisting economically distressed areas.

The program recently shifted away from providing services similar to those provided by SBDCs. The program is designed to help selected colleges and universities mobilize their resources to assist in the economic development of distressed areas. The older centers solely providing SBDC-type services are being phased out.

Technology assistance efforts are funded by the program, but only when they meet the objectives of the program.

There are currently fifty-one university centers, six of which were established in 1988 and four in 1989. Funding for fiscal 1988 was $4.8 million.

An example of an EDA university center is the Nebraska Technical Assistance Center, located at the University of Nebraska-Lincoln. Established in 1985, the center provides technical assistance and information to manufacturers and processors in the area of engineering and technology with the objective of helping these companies improve their productivity. Through these efforts the center seeks to produce a positive economic impact, as measured by increases in profits, job creation, and investments. Of those firms assisted in 1988, 81 percent were manufacturers, 68 percent were small businesses, and 27 percent were medium-sized businesses. The highest percentage of establishments assisted was small manufacturing firms (52 percent).

University centers responding to the survey (14) received a total of $16 million to provide their services. Most of their funding comes from state government (48 percent). The federal government contributes 30 percent, another 15 percent is provided by industry ($2.5 million) and 5 percent is provided by university sources. Two percent comes from other sources. Of the federally-supported programs, university centers generally receive the largest percentage of their funds from state government—almost twice as much as SBDCs.

University centers emphasize technology assistance over business assistance. Fifty-nine percent of total funds are allocated to technology assistance versus 37 percent to business assistance. This is true despite the fact that almost the same number of centers provide business assistance as provide technology assistance. University centers account for the largest percentage of federal program dollars going toward technology assistance (47 percent of total federal program dollars to technology assistance). University centers are, on a small scale, involved in incubators, research parks, seed capital, and technology research centers.

In 1988 university centers provided business assistance and technology assistance to more than 2,800 establishments. The centers provided assistance to an average of 300 clients per year, a much smaller number than are served during the same period by SBDCs. This may reflect the more technical nature of the services provided by the university centers.

University centers also concentrate more on serving manufacturing firms. Fifty-one percent of the establishments receiving business assistance in 1988 were manufacturing firms. Technology assistance was concentrated more heavily on manufacturers. Eighty-five percent of the firms receiving technology assistance were manufacturers.

The efforts of the university centers are concentrated on assisting smaller business (those with under 50 employees). Of the business assistance provided, 83 percent of the firms had less than 50 employees, and 16 percent had 50 to 500 employees. Seventy-seven percent of the firms receiving technology assistance were small businesses, 20 percent were mid-sized establishments.

The services provided by the university centers are tied to the types of resources the home-university can help provide. Of the centers responding, 100 percent reported providing management assistance and 91 percent provide small business consulting services. In addition, the majority of the centers provide feasibility studies, financial analysis, market surveys, site location assistance, and business plan development.

More than 90 percent of the centers provide technical consulting, networking, and seminars and workshops. The majority of the centers also provide technology assistance in product design, technical data, user requests, and technical literature. As is true of business assistance, these services rely on the resources and expertise available through the university at which the center is located.

The establishments assisted by university centers do not need extensive access to new technologies. Of those firms receiving business assistance services, 23 percent required access to new technologies and 55 percent to established technologies. Of the establishments provided technology assistance by university centers, an average of 28 percent required access to new technology and 53 percent required access to established technology.

Industrial Applications Centers

The Technology Utilization Program (TUP) of NASA employs several types of mechanisms intended to broaden and accelerate the transfer of aerospace technology to other sectors of the economy. A key element of TUP is the network of ten Industrial Applications Centers (IACs) affiliated with universities across the country. IACs offer clients access to a national data bank that includes over 100 million documents of accumulated technical knowledge and expertise in retrieving information and applying it in support of clients' needs. The IACs are backed by IAC Affiliates, state-sponsored business or technical centers, that provide access to the technology transfer network.

The Southern Technology Applications Center (STAC) in Alachua, Florida, is one of the ten Industrial Applications Centers. Founded in 1977, the center currently has just over thirty staff, 34 percent of which are technical and 25 percent business. STAC was founded by the State University System and NASA to provide state business and industry with easy access to the latest available information and technology. STAC activities and services can be grouped by information research and document procurement, education through focused seminars and workshops, and business assistance.

The activities of STAC involve the private, public, and academic sectors. STAC has six area offices throughout the state university system as well as affiliations with twenty-three universities in the south. Program funds of STAC are oriented primarily toward technology assistance (65 percent), although 15 percent of the funds are allocated to business assistance activities. The majority of the firms assisted by STAC are nonmanufacturing (67 percent) and small business (68 percent). The highest percentage of companies assisted is small nonmanufacturing companies (44 percent).

The NASA Industrial Applications Centers (IAC) responding to the survey received $9 million in funding for fiscal 1988. Funds were primarily from the federal government (55 percent), though university (18 percent) and industry (16 percent) contributions were significant. Ten percent were provided by other sources. States contributed only 1 percent.

The orientation of IAC programs is clearly toward technology assistance, with 85 percent of their funding allocated to those efforts. Only 10 percent of IAC funding is utilized for business assistance and minimal amounts of funds are used for other technology extension services. With only ten centers, the IACs account for one-third of the federal technology extension program money allocated for technology assistance by the organizations responding to the survey.

NASA IACs provided business assistance to more than 650 establishments, and technology assistance to more than 3,100 firms. Of the business assistance provided to IAC clients, approximately 70 percent was provided to manufacturing firms, and 30 percent to nonmanufacturing firms. Of the firms requiring technology assistance, 56 percent were manufacturing and 44 percent were nonmanufacturing.

Firms availing themselves of business assistance services differ in size from those using technology assistance services. Of those firms receiving business assistance, 90 percent had less than 50 employees and 9 percent had between 50 and 500 employees. The firms provided technology assistance were larger, with 45 percent employing less than 50 people, 29 percent between 50 and 500 employees, and 23 percent more than 500 people. The number of large firms receiving assistance is significantly greater than the other state and federal programs included in the study. This may be due to the nature of the aerospace industry.

Forty-two percent of the IACs indicated that they provide no business assistance services. Of those that do, 100 percent offer feasibility studies and small business consulting. In addition to this, 75 percent assist firms with management problems, market surveys, and site location decisions. The rest of the business assistance services are offered by a small percentage of the centers. Based on the types of services supplied, it appears that IAC business assistance efforts are those with a more technical focus.

In contrast, 100 percent of the IACs have a technology assistance emphasis. Of the technology assistance services provided, 100 percent of the IACs encourage networking, and disseminate technical data and literature; 86 percent conduct seminars/workshops, technical counseling, often responding to user requests and serving as state liaison; and 71 percent assist with product design. Only 28 percent of the IACs develop demonstration projects and 14 percent assist on the development of joint ventures.

The establishments assisted by IACs require access to new technologies more than any of the other federally supported programs. In business assistance services, an average of 33 percent of the establishments required access to new technologies, while 67 percent required access to established technologies. In technology assistance, the need was even greater. An average of 36 percent of the firms required access to new technologies, while 76 percent required access to established technologies. It is interesting to note, however, that even in the case of the IACs, whose mission is to

promote the transfer of NASA's technologies, the firms they deal with need access to existing—more often than advanced state-of-the-art—technology.

Trade Adjustment Assistance Centers

The International Trade Administration (ITA) of the United States Department of Commerce administers the Trade Adjustment Assistance Center (TAAC) program. The TAAC provides trade-impacted small and medium-sized manufacturers with in-depth technical assistance. TAAC assists firms in petitioning the Department of Commerce to show evidence of their lost sales and production as a result of import competition. Upon approval of the petition, TAAC conducts a diagnostic examination of the firm and provides an adjustment plan.

Twelve regional centers are in operation across the country. They operate as either independent nonprofit corporations or as affiliates of universities. Fiscal 1988 funding for the centers was $12.8 million.

Located in Los Angeles, the Western Trade Adjustment Assistance Center is an example of an ITA TAAC. Founded in 1978, the center staff consists of five professional and three support staff. The objectives of the center are to assist U.S. manufacturers in qualifying for trade adjustment assistance; assist U.S. manufacturers in defining areas of improvement; formulate implementation plans for executing these technical and/or business structural improvements; and assist with the implementation of structural, long-term improvements through technical assistance and project management activities. The orientation of the western TAAC is 63 percent technology assistance and 37 percent business assistance. All of the firms assisted in 1988 were manufacturing firms. Of these 63 percent are mid-sized companies (50 to 500 employees) and 37 percent are small businesses.

The TAAC centers received $6.6 million in fiscal 1988 funding. This is the smallest total budget of all the federally supported technology extension programs. TAAC centers receive 88 percent of their funding from the federal government. The second largest funding source for TAAC is industry, which provides $419,000 or only 6 percent of the total funds received. Local governments, universities, and other sources contribute 2 percent each of the TAAC budgets. The TAACs in the survey do not have any state government funding.

The TAACs mainly allocate funds to business assistance services (68 percent) and technology assistance services (27 percent). Because the services provided by TAACs are geared to helping businesses improve their management or processes, the business assistance component is emphasized more than technology assistance.

TAACs provided business assistance services to 260 establishments and technology assistance services to 80 establishments. The small number of clients reflects the fact that intensive services are provided to these firms.

In both business assistance and technology assistance efforts, 100 percent of the firms assisted were manufacturing firms. TAACs are the only federally supported extension effort that concentrates solely on manufacturing establishments.

Both business and technology assistance efforts concentrate on mid-sized firms, those with 50 to 500 employees. Of the business assistance services provided, 36 percent were to small firms, 60 percent to mid-sized firms, and 4 percent to large firms. In technology assistance services, 24 percent went to small firms, 71 percent to mid-sized, and 5 percent to large firms.

The TAACs consistently provide the most comprehensive services of the federally supported extension programs. All of the TAACs provide business assistance in the form of business plan development, financial analysis, business management, market surveys, and small business consulting. The other business assistance services are provided infrequently reflecting the nature of the TAAC program, (i.e., assisting trade - impacted manufacturers).

With regard to technology assistance services, 66 percent of the centers surveyed provide assistance in product design and technical counseling. In addition, at least one-third of the centers facilitate networking, offer technical data and literature, and respond to user requests. None of the centers surveyed supports demonstration projects or serve as state liaison.

Of the TAACs included in the survey, only five indicated that the businesses they serve required access to new or established technologies. Of those responding, 11 percent of the firm's assisted required access to new technologies, 59 percent to established technologies. The lack of responses on this question could indicate that among establishments seeking help from TAACs, their need for management and marketing assistance outweighs their need for technology assistance. It is surprising, however, that assisting these companies in modernizing their operations is not a major component of the TAAC program.

6. Relationship Between State and Federal Programs

In addition to the federal programs surveyed, a variety of additional federal programs provide assistance to small and medium-sized businesses. One element of this study was to examine the extent to which the state and federal programs described previously are aware of and use these federal programs and to assess their usefulness.

Overall the federal programs were rated highly by both the state and federal program managers. The programs with the most assessments of "good" included the Small Business Innovation Research Program; EDA's University Centers program; NASA's Commercial Use of Space and Technology Utilization Programs; the Department of Commerce's Office of Productivity, Technology and Innovation; and NSF's University/Industry Cooperative Research Centers program. (See Table 11.)[17]

An examination of these programs indicates that most of them were used by less than a third of the respondents. In some cases, this may be due to the fact that these programs provide very specialized services that are of interest to a limited number of firms. NASA's Commercial Use of Space Program, for example, may have limited value to the majority of the small to medium-sized manufacturers receiving assistance through these programs. It should also be noted that the survey responses indicate only whether the program is used by other service providers. It does not measure the extent to which these programs are used by individual businesses.

It may also be the case, however, that many of these programs are in fact underutilized. The Federal Laboratory Consortium, for example, is an initiative designed to provide access to the technical expertise of the staff of the nation's federal laboratory system, yet only 39 percent of the respondents have used the program. Greater outreach may be needed to make state program managers aware of the federal resources that are available to them.

In fact, the managers of the state programs indicated that the best way to facilitate the transfer of federal scientific and technical information, including the results and application of federal and federally funded research and technology, is by actively participating with federal agencies in their technology transfer programs. Additional strategies in order of importance are establishing training programs at the state and local level to make staff aware of federal activities, cosponsoring demonstration projects using new federally developed technology, and making use of a clearinghouse to disseminate information on federal research and development.

Table 11
Relationships with Federally Sponsored Programs

	Percent of Total Respondents Who Have Used the Program	*Percent of Total Respondents Giving the Program an Assessment of Good*
Small Business Innovation Research Program (All)	69	74
Small Business Development Center Program (SBA)	66	55
SCORE/ACE (SBA)	48	47
Patent and Trademark Office (Commerce)	43	62
Cooperative Extension Service (Agriculture)	43	68
Job Training Partnership Act (Labor)	41	60
Federal Laboratory Consortium (All)	39	63
Center for Utilization of Federal Technology (Commerce/NTIS)	36	60
Technology Utilization Program (NASA)	33	64
Community Development Block Grants (HUD)	30	57
Energy-Related Inventions (Energy and Commerce/NIST)	30	58
University Centers Program (Commerce/EDA)	27	69
Commercial Use of Space Program (NASA)	27	67
Office of Small and Disadvantaged Business Utilization (All)	27	46
Small Business Investment Companies (SBA)	27	47
Industry/University Cooperative Research Centers (NSF)	26	67
Trade Adjustment Assistance Centers Program (Commerce/ITA)	25	38
Office of Productivity, Technology, and Innovation (Commerce)	24	67
Energy Extension Service (Energy)	19	59
Computer and Information Science and Engineering (NSF)	18	61
National Appropriate Technology Assistance Service (Energy)	19	59
Measurement and Engineering Research Grants (Commerce/NIST)	8	53
Scientific, Technological, and International Affairs (NSF)	7	57
Trade Adjustment Assistance Workers (Labor)	6	46
Program for Mathematics, Science, Computer Learning and Critical Foreign Languages (Education)	2	50

SOURCE: Current State Technology Extension Services Survey, National Governors' Association, 1989.

Conclusions and Recommendations

This study identified a wide variety of programs providing direct assistance to small and medium-sized businesses. These programs differ greatly in the type of assistance provided and the extent to which they are designed to help U.S. manufacturers modernize, (i.e., to adapt and efficiently use productivity enhancing technologies). Such modernization requires changes in management structure and training for workers in addition to introducing new machinery, equipment and processes.

An examination of the state-supported programs shows that states are active in a number of technology development areas—including establishing technology research centers, supporting the development of incubators and research parks, and operating seed capital funds—in addition to providing business and technology assistance to small firms.

Most of these activities, however, are designed to encourage the creation of new firms, new products, and new processes along with marketplace strategies. Programs dealing specifically with the modernization of small and medium-sized manufacturers is a fairly small component of these overall technology development efforts.

Given the overwhelming agreement on the part of program managers that the businesses they assist require access to off-the-shelf existing technologies, it would appear that greater attention should be paid to assisting small and medium-sized firms in learning about and using such technology rather than concentrating on the application of state-of-the-art technology that is of use to a much smaller number of firms. For a firm that has yet to make efficient use of personal computers, for example, adoption of sophisticated CAD/CAM equipment is probably neither feasible nor desirable.

There also appears to be a mismatch between the services provided by the federal government and the needs of small and medium-sized businesses for technology assistance. Most of the federal resources accounted for by the programs in the study are used to provide businesses with management and business assistance rather than technology assistance.

SBDCs, which account for the largest investment of federal funds for those programs surveyed, provide general business assistance services. The extent to which they provide technology assistance is open to debate. While a number of the survey respondents indicated that they do, program managers of state technology extension programs attending an NGA roundtable suggested that most SBDCs do not have the technical expertise to assist firms in technological areas and should refer businesses needing technology assistance to other sources. Given the large number of SBDCs

throughout the country, it is likely that they differ greatly in their ability to provide such services.

Although university centers are more limited than the SBDC program in number—fifty-one centers as opposed to more than 500 SBDCs nationwide, they are more oriented toward technology assistance and in general work more with manufacturing firms. University centers were highly rated by the other program managers.

Federal programs with a technology orientation such as NASA's IACs concentrate on providing access to state-of-the-art technology, such as that coming out of the nation's federal laboratory system, rather than encouraging the diffusion and adoption of proven technologies. Although the IACs may offer a model for other federal agencies looking for ways to get the results of federal research into the marketplace, they are not vehicles for assisting in the adoption of existing technology.

The Trade Adjustment Assistance Center (TAAC) program is the one program that provides in-depth consulting services to help firms restructure and modernize. It is, however, a highly specific program that deals only with trade-impacted firms. Interestingly enough, the TAAC program emphasizes business assistance rather than technology assistance. This may be due to the financial condition of the firms assisted through the program, many of whom are in poor financial condition due to trade impacts.

Although the state programs also tend to emphasize the application of advanced state-of-the-art technology, a small number of state-supported programs are experimenting with providing technical assistance to firms that want to modernize. There is no comparable federal program dedicated to helping U.S. manufacturers modernize and improve their use of technology. (One exception may be the MANTECH program operated by the Department of Defense. This program was not included in the study.) An examination of these state efforts provides useful guidance in designing new programs.

First, to support a firm's need for modernization assistance, these programs emphasize client-directed problemsolving rather than pushing out new technology.

Second, the program managers recognize that it is difficult, if not impossible, to isolate a firm's needs. Technology extension programs find that their clients require management assistance and assistance in training employees as often as they require assistance in technology deployment. For this reason, most programs must provide a range of services. This raises the issue of staff expertise and the capacity of organizations to meet these needs. Given the range of organizations providing services to small firms, there may be a need for greater networking between the technology extension programs and other business assistance programs at both the state and regional level.

Third, the program managers emphasized the value of on-site personal field service in aiding firms. Given limited resources, there is an obvious trade-off in the number of firms served and the level of services provided. Programs serving large numbers of firms often provide access to databases and technical information. In contrast, those programs providing on-site technical consulting are only able to meet the needs of a small number of clients per year relative to the number of firms that could potentially benefit from assistance.

Fourth, it is virtually impossible for an industrial extension agent to become expert in the wide range of areas he or she will be called on to address. Most of the state programs have dealt with this issue by having a small core staff who have the ability to call on a large pool of specialists—faculty or consultants.

Fifth, while the survey collected information on whether workshops and seminars were held, it did not examine the extent to which the organizations surveyed assist firms in identifying and meeting their training needs. Program managers indicated both on the open-ended questions in the survey and at the NGA roundtable that training is a critical issue. The introduction of new technologies and techniques often require that workers develop new skills and in some cases necessitate changes in labor/management relationships. Although most of the state programs acknowledge the need for training, few have formal training components in their programs.

This analysis of state-supported technology extension programs leads to some specific recommendations regarding any future federal role or expanded state role in technology extension.

- *Both state and federal governments should increase their emphasis on improving and diffusing already proven manufacturing technology.* State governments should examine their technology development strategies to determine the extent to which existing programs seek to assist firms to deploy technology. Federal efforts to promote technology transfer should be broadened to consider how federal resources can be used to help small and medium-sized manufacturers solve problems encountered in adopting technology.

- Even within the small number of state technology extension programs, there is a great deal of variation. The programs differ in structure, outreach, and services provided. New Jersey's program has established technology-specific centers to work with particular industries, for example, whereas other programs make services available to all manufacturers or all small and medium-sized firms. Some programs employ field staff who provide on-site assistance services. Others operate a central office that refers clients to a variety of resources. *Any federal effort to support technology extension activities should recognize and encourage varied approaches.*

- Although a number of states have developed significant technology extension efforts, these programs are not universal across all states. *One option for federal activity is to assist the states without programs in initiating technology extension services while supporting and learning from existing state programs.* This could be accomplished by establishing a matching grant program and/or funding demonstration projects designed to identify model approaches.

- *Both federal and state programs to support technology extension should consider ways to provide training as an element of the services provided.*

- There is little data available to measure the effectiveness of the varying approaches being tried in the states. *Additional research is needed to increase knowledge about the way in which technology is diffused and adopted*

by small businesses and to identify ways to facilitate this process. The federal government can play an important role in identifying examples of successful programs.

- *A national network should be established* to familiarize state officials with various approaches, effective evaluation methods, innovative ideas, and minimum standards of effective performance.

The modernization of the nation's existing manufacturing base is a critical issue. Working in cooperation with the federal government, state governments can serve as catalysts to encourage the diffusion and adoption of technology. Current efforts in this area are modest. Expanding these efforts will require additional resources.

The Omnibus Trade and Competitiveness Act of 1988 authorized the establishment of a technology extension program within the National Institute of Standards and Technology. It must be realized that to meet the needs of even a small percentage of the nation's small and medium-sized manufacturers will require a great commitment of resources. The agricultural extension service, which serves 800,000 commercial farmers, for example, received $1.5 billion in 1987 funding, one-third of which came from the federal government.

In the long run, ways must be found to enable small and medium-sized companies to develop their own capacity to remain technologically competitive. Trade associations, technology vendors, and manufacturing networks each have a role to play in supporting small manufacturers. Both state and federal governments should enlist the support and involvement of these groups to improve the capacity of small firms to manage and deploy technology.

Endnotes

1 "Smaller Firms Lag in Technology Use," TechnEcon, Industrial Technology Institute, vol. 1, no.1 (spring 1989), p. 7.

2 Ibid.

3 Minnesota Office of Science and Technology, *State Technology Programs in the United States 1988*, July 1988, p. 5.

4 The use of these "coordinators" may bias the data in favor of the state programs with which they are most familiar. In most cases, however, the state coordinators are senior officials responsible for coordinating the state's science and technology efforts and are therefore familiar with most state-funded activities.

5 Much of the funding listed as university funding may originate as state funding for public universities. Other sources of university funding would be through gifts, contributions, or tuition.

6 The number of organizations is understated since some states completed one survey form covering a number of individual organizations funded by the state under a single state program.

7 Respondents were categorized as metropolitan or nonmetropolitan using U.S. Department of Agriculture BEALE codes. These codes indicate metropolitan status in accordance with Office of Management and Budget designations as of June 1983.

8 It should be noted that the development of new technology and its application by existing and new firms are two very distinct activities. They are not separated in the study because many of the state initiatives seek to both encourage the development of new technological products and processes while at the same time encouraging the application of technology in the industrial sector.

9 In most cases the number of respondents that reported providing a service is not exactly equal to the number that responded to a particular section or question. This is due to the fact that some of the respondents were unable to provide all of the data requested. The analysis in this and the following sections is based on the number of respondents that completed each section rather than the number that reported providing a service.

10 David N. Allen, *Creating Jobs by Creating Businesses: The Role of Business Incubators*, (Washington, D.C.: National Council for Urban Economic Development, 1985), p. 51.

11 David N. Allen and Mark L. Weinberg, *The State's Role in Incubator Planning and Operation*, (Washington, D.C.: National Council for Urban Economic Development, February 1989), p. 1.

12 Harvey A. Goldstein and Michael I. Luger, "Research Parks: Do They Stimulate Regional Economic Development?" *Economic Development Commentary*, Spring 1989, pp.3-8.

13 Ibid, p. 8.

14 John Forrer, *State Competitive Research Grant Programs*, (Washington, D.C.: National Governors' Association, June 1989), p. 11.

15 Paul B. Phelps, *Centers of Excellence: A Catalogue*, LFW Management Associates, Alexandria, Va., January 1988.

16 This $25 million figure includes the budget of the Industrial Technology Institute but excludes the budget of the Georgia Tech Industrial Extension Program. The budget figures for the latter include funding for the Southeastern Trade Adjustment Assistance Center, an EDA University Center, and an Apparel Manufacturing Technology Center in addition to extension activities. Thus the total budget would greatly overstate the dollars allocated to extension activities exclusively. While ITI also operates a number of different programs, they are all aimed at encouraging the adoption of productivity enhancing technologies in the durable goods industry.

17 So as not to bias the data, respondents were excluded from the question of whether they had used a program with which they are affiliated. Thus SBDCs, for example, are not included in the data on the number of respondents who have used the SBDC program. Likewise they were excluded from their assessment of the program.

Appendix I

NGA/NIST Roundtable Participants

NGA/NIST Roundtable
List of Attendees

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Appendix II

Survey of State Technology Extension Services Questionnaire

Return to:

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Code #

A STUDY OF CURRENT STATE TECHNOLOGY EXTENSION SERVICES

PROGRAM MANAGER'S QUESTIONNAIRE

Congress and the Administration have called upon the National Institute of Standards and Technology, formerly the National Bureau of Standards, to carry out a program of technology development and transfer in collaboration with industry, universities, other Federal agencies, and with State and local governments. Among the National Institute of Standards and Technology's new responsibilities outlined in the Technology Competitiveness Act portion of the Trade Bill, is a Study of Current State Technology Extension Services. The Study is being undertaken jointly with the National Governors' Association (NGA) with advice and guidance from the NGA Working Group on State Initiatives in Applied Research.

The purpose of the Study is to provide an understanding of what each State is doing to promote technological innovation and job creation. This information will be useful to Congress in identifying a Federal role which is supportive of State efforts and will be of use to Governors in assessing the effectiveness of their technology extension efforts.

This questionnaire is designed for use by managers of a technology extension program. A separate, summary questionnaire, has been designed for use by State coordinators who may be responsible for a variety of programs in their State.

The questionnaire for this portion of the Study is divided into two parts:

1. Background Information
2. Program Orientation

Part 1 contains 2 sections. Part 1 is designed to collect information on your program and on its relationships with several key Federal programs. The two sections of Part 1 are entitled:

I. General Information
II. Relationships With Federally-Sponsored Programs

Part 2 contains 6 sections. Each section refers to a specific program focus. **Only those sections which are of major importance to your program require a response.** The six sections in Part 2 are concerned with the following extension program activities:

III. Business Assistance
IV. Incubators
V. Research Parks
VI. Seed Capital
VII. Technology Assistance
VIII. Technology/Research Centers

We would like to thank you in advance for your cooperation and support. We know that the completion of the questionnaire will require time and effort on your part but we believe the final product will be useful to you and your colleagues in other States. If you have any questions, please call Marianne Clarke at (202) 624-5380.

PLEASE RETURN BY MAY 19, 1989

This questionnaire was approved by the Office of Management and Budget (OMB) on September 28, 1988, OMB Control Number 0693-0007.

PART 1: BACKGROUND INFORMATION

SECTION I: GENERAL INFORMATION

1. Organization Name: _____

2. Administering Agency: _____

3. Address: a) _____

   b) _____

   c) _____

4. City: _____ 5. State: _____

6. Zip Code _____ 7. Date Established: _____

8. Director: _____

9. Title: _____

10. Telephone: _____

11. Principal Contact: _____

12. Title: _____

13. Telephone: _____

14. Telecopier: _____

15. Number of staff (full-time equivalent) employed (as of June 30, 1988):

    a) Professional (Technical): _____

    b) Professional (Business): _____

    c) Support Staff: _____

16. Organizational Objectives (50 words or less):

17. **Financial Data:** Estimate the total funds (including overhead and any other operating costs) received or anticipated (in thousands of $) by your organization by fiscal year from each of the sources listed below. Indicate when your fiscal year begins (_____).

Source of Funds	Funds (thousands of $)			
	1986	1987	1988	1989(est)
a) Federal Government				
b) State Government				
c) Local Government				
d) University				
e) Industry				
f) All Other				
TOTAL				

18. **Outreach:** Below is a list of strategies for increasing the your clients awareness of how your program could benefit them. Indicate the importance of each strategy by showing how you would allocate $100 of program funds among them.

Strategies	How would you allocate $100?
a) Advertising (e.g., journals, radio, trade associations, etc.)	_____
b) Direct solicitation	_____
c) Field agents	_____
d) Networking (e.g., seminars, workshops, etc.)	_____
e) Other (_____ _____)	_____

Please use the following definitions in answering question 19.

Business Assistance: Business assistance focuses on providing general business management information such as personnel, accounting and legal advice.
Incubators: Incubator facilities provide office and lab space for start-up companies at below-market rates. Shared support services such as clerical, reception and data processing are often made available.
Research Parks: Research parks are planned groupings of technology companies that encourage university/private relationships.
Seed Capital: Money is provided for projects that are at an early stage of development or that offer job creation potential but may not have the return on investment expected by commercial venture capitalists. Includes research grant and product development programs.
Technology Assistance: Technology assistance focuses on providing specialized services such as technical information, invention evaluation, technical counseling and patent infromation. Technology assistance includes both information exchange and active out-reach programs to provide access to newly-created technologies and to promote innovative applications of established technologies.
Technology/Research Centers: These centers generally concentrate their studies in a particular field which is usually based on the strengths of the university and/or the major industries in the State.

19. **Program Orientation:** Estimate the percent of staff resources allocated to each functional area during **1988.** Estimate the percent of total funds allocated to each functional area during **1987, 1988 and 1989.**

Functional Area	Percent of Staff 1988	Percent of Funds		
		1987	1988	1989(est)
a) Business Assistance				
b) Incubators				
c) Research Parks				
d) Seed Capital				
e) Technology Assistance				
f) Technology/Research Centers				
g) Other: _____ _____				
TOTAL	100	100	100	100

SECTION II: RELATIONSHIPS WITH FEDERALLY-SPONSORED PROGRAMS

20. If your organization **has used or been associated** with a specific program, provide an assessment of how well that program complements your organization's objectives.

Program Name	Have Used Program Y=Yes N=No	If Yes, Frequency of Use 1=Frequent 2=Sometimes 3=Seldom	If Yes, Program Assess. 1=Good 2=Fair 3=Poor
a) Center for Utilization of Federal Technology (Commerce/NTIS)	☐	____	____
b) Commercial Use of Space Program (NASA)	☐	____	____
c) Community Development Block Grants (HUD)	☐	____	____
d) Computer and Information Science and Engineering (NSF)	☐	____	____
e) Cooperative Extension Service (Agriculture)	☐	____	____
f) Energy Extension Service (Energy)	☐	____	____
g) Energy-Related Inventions (Energy and Commerce/NBS)	☐	____	____
h) Federal Laboratory Consortium (All)	☐	____	____
i) Industry/University Cooperative Research Centers (NSF)	☐	____	____

20. (Continued)

Program Name	Have Used Program Y=Yes N=No	If Yes, Frequency of Use 1=Frequent 2=Sometimes 3=Seldom	If Yes, Program Assess. 1=Good 2=Fair 3=Poor
j) Job Training Partnership Act (Labor)	☐	___	___
k) Measurement and Engineering Research Grants (Commerce/NBS)	☐	___	___
l) National Appropriate Technology Assistance Service (Energy)	☐	___	___
m) Office of Productivity, Technology and Innovation (Commerce)	☐	___	___
n) Office of Small and Disadvantaged Business Utilization (All)	☐	___	___
o) Patent and Trademark Office (Commerce)	☐	___	___
p) Program for Mathematics, Science, Computer Learning and Critical Foreign Languages (Education)	☐	___	___
q) Scientific, Technological and Internatiional Affairs (NSF)	☐	___	___
r) SCORE/ACE (SBA)	☐	___	___
s) Small Business Development Center Program (SBA)	☐	___	___
t) Small Business Innovation Research Program (All)	☐	___	___

20. (Continued)

Program Name	Have Used Program Y=Yes N=No	If Yes, Frequency of Use 1=Frequent 2=Sometimes 3=Seldom	If Yes, Program Assess. 1=Good 2=Fair 3=Poor
u) Small Business Investment Companies (SBA)	☐	_____	_____
v) Technology Utilization Program (NASA)	☐	_____	_____
w) Trade Adjustment Assistance Centers Program (Commerce/ITA)	☐	_____	_____
x) Trade Adjustment Assistance Workers (Labor)	☐	_____	_____
y) University Centers Program (Commerce/EDA)	☐	_____	_____
Other Federal Programs (Please List)			
aa)_____ _____	☐	_____	_____
bb)_____ _____	☐	_____	_____
cc)_____ _____	☐	_____	_____

21. Below is a list of strategies through which your organization does or could facilitate the transfer of Federal scientific and technical information, including the results and application of Federal and Federally-funded research/technology. Indicate the importance of each strategy by showing how you would allocate $100 of program funds among them.

Strategies	How would you allocate $100?
a) Cooperate actively with Federal agencies in their technology transfer programs	_____
b) Cosponsor model demonstration projects	_____
c) Draw on a Federal clearinghouse to disseminate information on Federal R&D	_____
d) Maintain a training program at the State and local level focused on Federal technology transfer and cooperation	_____

22. Provide comments and/or indicate other ways in which your organization does/could promote:

a) Federal technology transfer:

b) Technology transfer in general:

PART 2: PROGRAM ORIENTATION

SECTION III: BUSINESS ASSISTANCE

Answer questions 23 through 27 if your organization provides business assistance.

23. **Type of Service:** Check the box in **Column 1** if your organization provided that service during **1985, 1986 or 1987.** Check the box in **Column 2** if your organization is **currently providing** that service. Check the box in **Column 3** if your organization is either providing that service at an increased level or is planning an expansion in 1989.

Type of Service	Column 1 Provided 85, 86, 87	Column 2 Provided 88	Column 3 Expanded 88 or 89
a) Business Forecasting	☐	☐	☐
b) Business Plan Preparation/Evaluation	☐	☐	☐
c) Feasibility Studies	☐	☐	☐
d) Financial Analysis	☐	☐	☐
e) Joint Venture/Partnership Counseling	☐	☐	☐
f) Labor Analysis	☐	☐	☐
g) Management Assistance and Studies	☐	☐	☐
h) Marketing Surveys	☐	☐	☐
i) Site Location Assistance	☐	☐	☐
j) Small Business Consulting	☐	☐	☐

24. Estimate the number of establishments assisted:

a) 1985: _____
b) 1986: _____
c) 1987: _____
d) 1988: _____
e) 1989: _____

25. **Establishment Data:** Estimate the number of establishments assisted by your organization during **1988**. Please classify establishments by type (manufacturing versus non-manufacturing) and size. An establishment, as defined by the Census, counts each store, office, or plant with one or more employees as a separate entity. Non-manufacturing establishments are those major industry groups involved in: agriculture, mining, construction, and services (transportation, finance, government enterprises, etc.).

Type of Establishment	Number of Establishments				TOTAL
	Less than 50	Between 50 & 500	More than 500	Don't Know	
Manufacturing					
Non-Manufacturing					
Don't Know					
TOTAL					

26. **Assistance to Individuals:** Estimate the number of individuals assisted (e.g., innovators, entrepreneurs, etc.) during **1988**: _____.

27. Percentage of establishments assisted during **1988** which required access to:

a) Newly-created technologies: _____
b) Established technologies: _____

SECTION IV: INCUBATORS

Answer questions 28 through 32 if your organization supports incubators.

28. Provide estimates of the following background statistics:

	Number of Incubators	Number of Establish-ments	Number of Employees	Number of Graduates
a) 1985:	_____	_____	_____	_____
b) 1986:	_____	_____	_____	_____
c) 1987:	_____	_____	_____	_____
d) 1988:	_____	_____	_____	_____
e) 1989:	_____	_____	_____	_____

29. Percentage of establishments incubated during **1988** which required access to:

a) Newly-created technologies: _____
b) Established technologies: _____

30. Percentage breakdown by type of technology targeted during **1988**:

a) Aerospace: _____
b) Biotechnology and Life Sciences: _____
c) Earth Sciences: _____
d) Information Technologies: _____
e) Manufacturing Technologies: _____
f) Materials Sciences: _____
g) Other (_____

_____): _____

31. Number of years an establishment spends in an incubator:

a) Average: _____
b) Maximum: _____

32. Percentage of establishments graduated between **1985 and 1987** which:

a) Are Still in Business: _____
b) Are No Longer in Business: _____
c) Don't Know: _____

SECTION V: RESEARCH PARKS

Answer questions 33 through 35 if your organization supports research parks.

33. Provide estimates for the following background statistics:

	Number of Parks	Percent of Available Space Occupied (Square Feet)
a) 1985:	_____	_____
b) 1986:	_____	_____
c) 1987:	_____	_____
d) 1988:	_____	_____
e) 1989:	_____	_____

34. Provide estimates for the following establishment statistics:

	Number of Establishments	Number of Employees
a) 1985:	_____	_____
b) 1986:	_____	_____
c) 1987:	_____	_____
d) 1988:	_____	_____
e) 1989:	_____	_____

35. Percentage breakdown by type of technology targeted during 1988:

a) Aerospace: _____
b) Biotechnology and Life Sciences: _____
c) Earth Sciences: _____
d) Information Technologies: _____
e) Manufacturing Technologies: _____
f) Materials Sciences: _____
g) Other (_____

_____): _____

SECTION VI: SEED CAPITAL

Answer questions 36 through 41 if your organization provides seed capital.

36. Establishments assisted:

Year	Number of Establish-ments	Public (thousands of $)		Private (thousands of $)
		Pension	Other	
1985				
1986				
1987				
1988				
1989				

37. **Establishment Data:** Estimate the number of establishments assisted by your organization during **1988**. Please classify establishments by type (manufacturing versus non-manufacturing) and size. An establishment, as defined by the Census, counts each store, office, or plant with one or more employees as a separate entity. Non-manufacturing establishments are those major industry groups involved in: agriculture, mining, construction, and services (transportation, finance, government enterprises, etc.).

Type of Establishment	Number of Establishments				TOTAL
	Less than 50	Between 50 & 500	More than 500	Don't Know	
Manufacturing					
Non-Manufacturing					
Don't Know					
TOTAL					

38. Percentage of establishments assisted between 1985 and 1987 which:

a) Are Still in Business: _____
b) Are No Longer in Business: _____
c) Don't Know: _____

39. Percentage of establishments assisted during 1988 which required access to:

a) Newly-created technologies: _____
b) Established technologies: _____

40. Percentage breakdown by type of technology targeted during 1988:

a) Aerospace: _____
b) Biotechnology and Life Sciences: _____
c) Earth Sciences: _____
d) Information Technologies: _____
e) Manufacturing Technologies: _____
f) Materials Sciences: _____
g) Other (_____

_____): _____

41. Percentage breakdown by type of funds provided during 1988:

a) Product/process development: _____
b) Product/process testing: _____
c) Prototype development: _____
d) Product/process commercialization: _____
e) Other: _____

SECTION VII: TECHNOLOGY ASSISTANCE

Answer questions 42 through 48 if your organization provides technology assistance.

42. **Type of Service:** Check the box in **Column 1** if your organization provided that service during **1985, 1986 or 1987.** Check the box in **Column 2** if your organization is **currently providing** that service. Check the box in **Column 3** if your organization is either providing that service at an increased level or is planning an expansion in 1989.

Type of Service	Column 1 Provided 85, 86, 87	Column 2 Provided 88	Column 3 Expanded 88 or 89
a) Demonstration Projects	☐	☐	☐
b) Joint Venture/Partnership Counseling	☐	☐	☐
c) Networking & Referrals	☐	☐	☐
d) Product Design and/or Evaluation	☐	☐	☐
e) Seminars/Workshops	☐	☐	☐
f) State liaison to Federal Labs	☐	☐	☐
g) Technical Counseling	☐	☐	☐
h) Technical Data Services	☐	☐	☐
i) Technical literature dissemination/review	☐	☐	☐
j) User request and response	☐	☐	☐

43. Estimate the number of establishments assisted:

a) 1985: _____
b) 1986: _____
c) 1987: _____
d) 1988: _____
e) 1989: _____

44. **Establishment Data:** Estimate the number of establishments assisted by your organization during **1988**. Please classify establishments by type (manufacturing versus non-manufacturing) and size. An establishment, as defined by the Census, counts each store, office, or plant with one or more employees as a separate entity. Non-manufacturing establishments are those major industry groups involved in: agriculture, mining, construction, and services (transportation, finance, government enterprises, etc.).

Type of Establishment	Number of Establishments				TOTAL
	Less than 50	Between 50 & 500	More than 500	Don't Know	
Manufacturing					
Non-Manufacturing					
Don't Know					
TOTAL					

45. **Assistance to Individuals:** Estimate the number of individuals assisted (e.g., innovators, entrepreneurs, etc.) during **1988**: _____.

46. Percentage of establishments assisted during **1988** which required access to:

a) Newly-created technologies: _____
b) Established technologies: _____

47. Percentage breakdown by type of technology targeted during 1988:

a) Aerospace: _____
b) Biotechnology and Life Sciences: _____
c) Earth Sciences: _____
d) Information Technologies: _____
e) Manufacturing Technologies: _____
f) Materials Sciences: _____
g) Other (_____

_____): _____

48. Percentage breakdown by type of assistance provided during 1988:

a) Product/process development: _____
b) Product/process testing: _____
c) Prototype development: _____
d) Product/process commercialization: _____
e) Other: _____

SECTION VIII: TECHNOLOGY/RESEARCH CENTERS

Answer questions 49 and 50 if your organization supports technology centers or research centers.

49. Provide estimates for the following background statistics:

	Number of Centers	Number of Establishments Participating
a) 1985:	_____	_____
b) 1986:	_____	_____
c) 1987:	_____	_____
d) 1988:	_____	_____
e) 1989:	_____	_____

49. Background statistics (continued):

	Number of Small and Medium-sized Establishments	Number of Manufacturing Establishments
a) 1985:	_____	_____
b) 1986:	_____	_____
c) 1987:	_____	_____
d) 1988:	_____	_____
e) 1989:	_____	_____

50. Percentage breakdown by type of technology targeted during **1988**:

a) Aerospace: _____
b) Biotechnology and Life Sciences: _____
c) Earth Sciences: _____
d) Information Technologies: _____
e) Manufacturing Technologies: _____
f) Materials Sciences: _____
g) Other (_____

_____): _____

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[ ] DOCUMENT DESCRIBES A COMPUTER PROGRAM; SF-185, FIPS SOFTWARE SUMMARY, IS ATTACHED.

11. ABSTRACT (A 200-WORD OR LESS FACTUAL SUMMARY OF MOST SIGNIFICANT INFORMATION. IF DOCUMENT INCLUDES A SIGNIFICANT BIBLIOGRAPHY OR LITERATURE SURVEY, MENTION IT HERE.)

This report presents the findings of a Nationwide survey of state and federal organizations providing business and technology assistance to small and medium-sized businesses. Information was collected on the nature of the services provided by these organizations, the type of firms being assisted, and methods used to reach potential clients. In addition, the survey solicited the views of program managers regarding the needs of small and medium-sized businesses for information on new and existing technologies and ways to improve the transfer of federal technology to potential users in the small business community. The report also contains short descriptions of specialized technology extension services in seven states. Finally, the report recommends actions states should take in expanding their technology assistance efforts and the federal government should take to support these efforts.

12. KEY WORDS (6 TO 12 ENTRIES; ALPHABETICAL ORDER; CAPITALIZE ONLY PROPER NAMES; AND SEPARATE KEY WORDS BY SEMICOLONS)
Business assistance; economic development; extension services; technology assistance; technology transfer.

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